APPENDIX A

BASE PLAN

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CLEVELAND HARBOR DMMP
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Cleveland Harbor DMMP

“Base Plan” Dredging Plan

I. INTRODUCTION

The Cleveland Harbor Dredge Material Management Plan (DMMP) is a document that presents a plan for managing dredged material removed from Cleveland Harbor river and harbor channels for the next 20 years. The Cleveland DMMP developed a number of plans that would allow dredging at Cleveland harbor to continue for the next 20 years. These plans need to be compared to a “Base Case” dredging plan. In other words, if there were no DMMP, how would dredge material at Cleveland Harbor be disposed of for the next 20 years? The costs associated with the dredging plans developed by the DMMP will be compared to the “Base Case” condition dredging costs. This “Base Case” is one of many “With Project” conditions. It can also be referred to as the “Federal Standard”. This Appendix documents the process of identifying the “Base Plan“, its components and costs. The project evaluation period for this DMMP is 2009-2028.

A. Cleveland Harbor Location

Cleveland Harbor, Cuyahoga County, Ohio, is located on the south shore of Lake Erie at the mouth of the Cuyahoga River. The port is 28 miles east of Lorain Ohio and 33 miles west of Fairport Harbor Ohio (Figure 1.)

Figure 1. Port Location

B. Cleveland Harbor Description

The harbor consists of a lakefront; breakwater protected outer harbor (Figure 2, Figure 3) and an inner harbor (Figure 4, Figure 5). The inner harbor is the lower deep draft section of the Cuyahoga River, and the connecting Old River. Authorized and maintained channel dimensions are presented in Table 1.

TABLE 1
AUTHORIZED AND MAINTAINED CHANNEL DIMENSIONS (LWD)

REACH OR SEGMENT	NOMINAL CHANNEL DEPTH		NOMINAL CHANNEL WIDTH		MAX. SAILING DRAFT
	(as auth.)	(as maint.)	(as auth.)	(as maint.)	
Lake Approach	29'	29'	600'-750’	600'-750’	29’
Outer Harbor West Basin	28'	28'	1,500'	1,500'	28’
Outer Harbor East Basin	28’-25'	28’-25’	Varies 1,500’-500’	Varies 1,500’-500’	28’-25’
Cuyahoga River	23'	23'	Varies 130’-325’	Varies 130’-325’	23'
Old River	27'	23’-21'	200’-400'	200’-400'	23’-21’
Turning Basins	18'	18'	690'	690'	--

The outer harbor is a breakwall-protected area of about 1,300 acres. The outer harbor is 5 miles long, 1,600 to 2,400 feet wide, composed of an east breakwater (20,970 feet long) and a shore connected west breakwater (6,048 feet long). There is a 201-foot gap in the West breakwater about 662 feet from the shore end. The main entrance channel has east and west arrowhead breakwaters, both of which are 1,250 feet long. The arrowhead breakwaters are 600 feet apart.

The inner harbor includes the lower 5.8 miles of the Cuyahoga River and approximately one mile of the Old River. The Cuyahoga River is in line with the main entrance to the outer harbor from the lake. The entrance channel is protected by two parallel piers, 325 feet apart. The width of the Cuyahoga River varies from 130 to 325 feet. A turning basin is located approximately 4.8 miles upstream of the Cuyahoga Rivers mouth. The Old River extends westward from a point about 0.4 miles above the mouth of the Cuyahoga River. The Old River varies in width from 200 to 400 feet.

There are two entrances to the outer harbor. The main entrance (the Lake Approach Entrance Channel) is located between the east and west breakwater. The other entrance is at the east end of the east basin, between the east breakwater and the shore. Authorized channel depths in these entrance areas are at least are 29 feet below Low Water Datum (LWD). LWD for

Figure 2.- Cleveland Harbor – Overview-Outer Harbor

Figure 3- Cleveland Harbor-Outer Harbor- Looking East

Figure 4. Cleveland Harbor- Inner Harbor-Old River

Figure 5-Cleveland Harbor-Inner Harbor-Cuyahoga River

Lake Erie is 569.2 feet above mean sea level at Rimouski, Province of Quebec, Canada, IGLD 85. Authorized channel depths in the outer harbor are 28 feet below LWD in the west basin and 28 to 25 feet in the east basin.

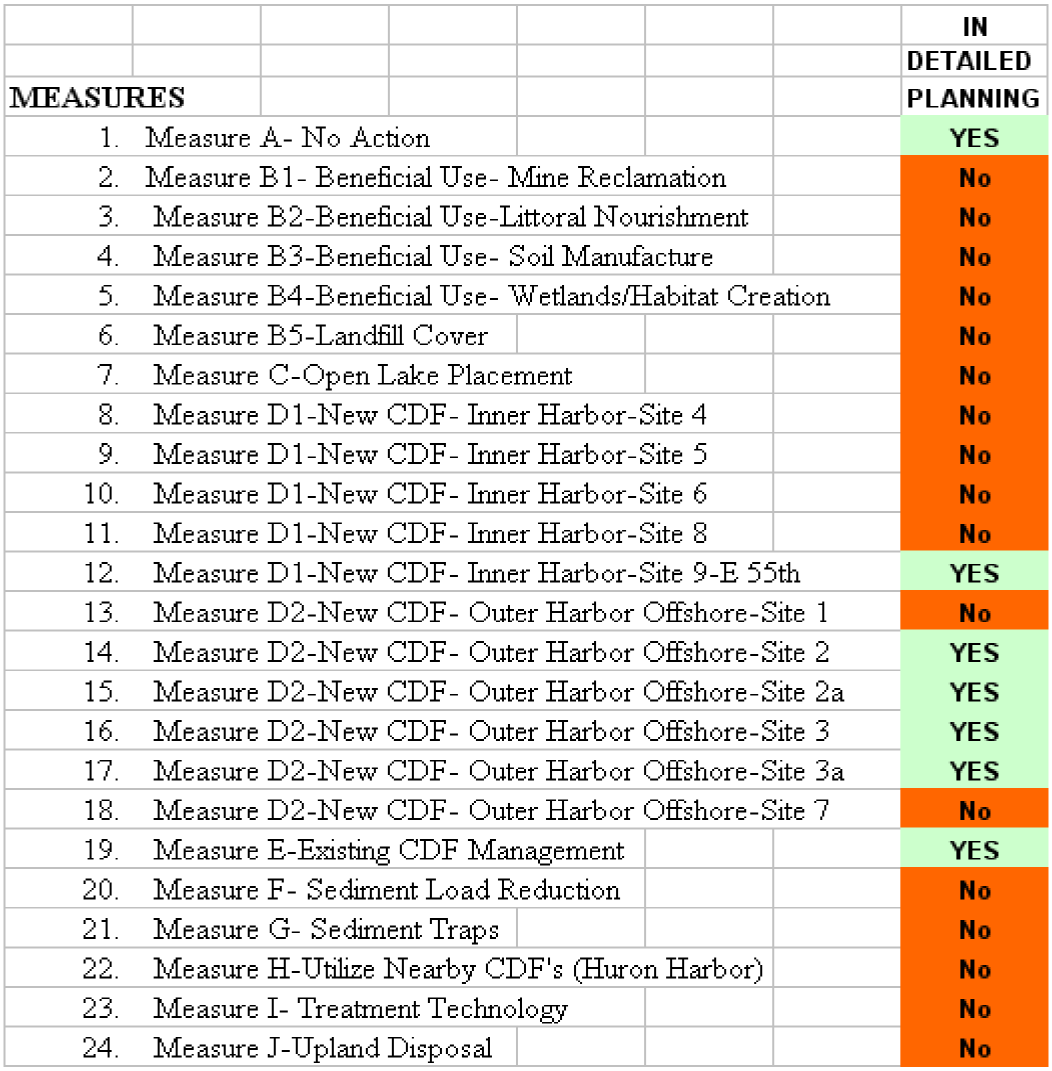
The project provides an authorized depth of 27 feet in the lowermost part of the Cuyahoga River, from the lakeward end of the piers to a point immediately above the junction with the Old River. Authorized channel depths in the remaining portions of the Cuyahoga River are 23 feet. The Old River is maintained to 23 and 21 feet.

Cleveland Harbor is dredged every year. The average dredging volume per dredging event since 1998 is 330,200 cubic yards. Confined disposal facility (CDF) 10b is the current operational CDF. All sediment dredged at Cleveland is placed into a CDF.

II. MEASURES

The Cleveland Harbor Dredge Material Management Plan (DMMP) developed a number of measures (24), including the "No Action", that could be used to develop plans that addressed the need to dispose of dredged material removed from the Harbors river and approach channels for the next 20 years. These 24 measures are listed in Table 2. Figure 6 provides a schematic of potential CDF site locations at Cleveland Harbor associated with Measure D-New CDFs. Table 3 presents a relative comparison of the physical characteristics of the eleven preliminary CDF configurations, which includes an iteration of proposed CDF 2 and CDF 3.

Table 2- Initial Measures Identified As Potential Components Of Plans



MEASURES	IN DETAILED PLANNING
1. Measure A- No Action	YES
2. Measure B1- Beneficial Use- Mine Reclamation	No
3. Measure B2-Beneficial Use-Littoral Nourishment	No
4. Measure B3-Beneficial Use- Soil Manufacture	No
5. Measure B4-Beneficial Use- Wetlands/Habitat Creation	No
6. Measure B5-Landfill Cover	No
7. Measure C-Open Lake Placement	No
8. Measure D1-New CDF- Inner Harbor-Site 4	No
9. Measure D1-New CDF- Inner Harbor-Site 5	No
10. Measure D1-New CDF- Inner Harbor-Site 6	No
11. Measure D1-New CDF- Inner Harbor-Site 8	No
12. Measure D1-New CDF- Inner Harbor-Site 9-E 55th	YES
13. Measure D2-New CDF- Outer Harbor Offshore-Site 1	No
14. Measure D2-New CDF- Outer Harbor Offshore-Site 2	YES
15. Measure D2-New CDF- Outer Harbor Offshore-Site 2a	YES
16. Measure D2-New CDF- Outer Harbor Offshore-Site 3	YES
17. Measure D2-New CDF- Outer Harbor Offshore-Site 3a	YES
18. Measure D2-New CDF- Outer Harbor Offshore-Site 7	No
19. Measure E-Existing CDF Management	YES
20. Measure F- Sediment Load Reduction	No
21. Measure G- Sediment Traps	No
22. Measure H-Utilize Nearby CDF's (Huron Harbor)	No
23. Measure I- Treatment Technology	No
24. Measure J-Upland Disposal	No

Figure 6 Existing And Potential CDF Sites At Cleveland Harbor

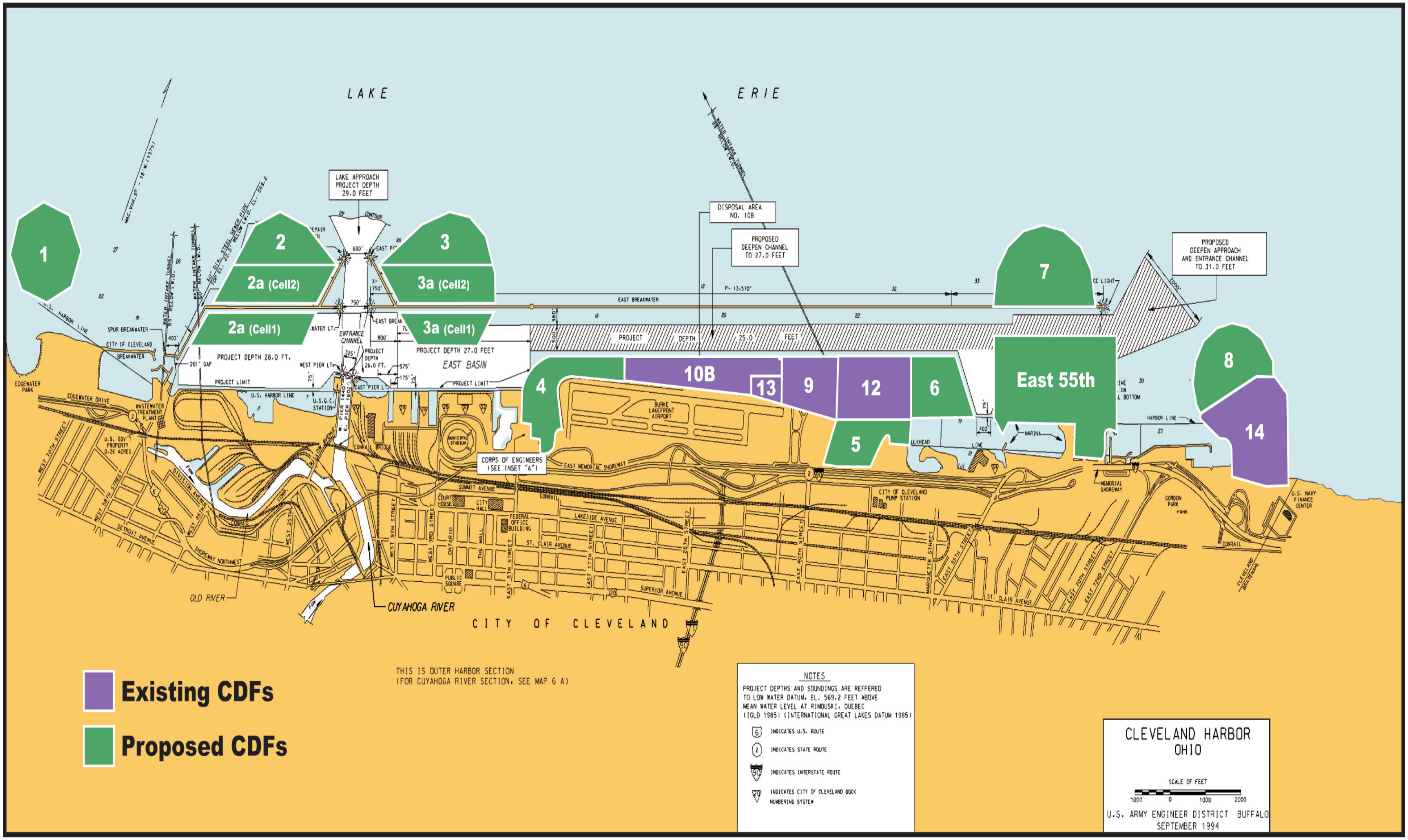


Table 3- Preliminary CDF Characteristics

Proposed Site	Area (acres)	Perimeter (Feet)	Average Existing Lakebed Elevation (feet LWD)	Final Dredge Fill Elevation (feet LWD)	New CDF Perimeter (feet)	Typical X-Sectional Area for New CDF (square feet)	Preliminary Rough Cost Estimate (Millions)	Design Capacity (cy)	Design Capacity (years)*
CDF 1	71	6400	-22	20	6400	4900	$198	4,300,000	13
CDF 2	108	9100	-26	20	9100	6000	$242	7,200,000	21
CDF 2a (Cell 1)	65	8300	-20	10	8300	NA**	$210	2,620,000	8
CDF 2a (Cell 2)	65	8540	-23	20	5250	6000	$115	4,490,000	13
CDF 3	117	9180	-22	20	9400	4900	$210	7,200,000	21
CDF 3a (Cell 1)	50	8300	-17	10	8400	NA**	$132	1,800,000	5
CDF 3a (Cell 2)	79	10680	-22	20	6760	4900	$197	4,650,000	14
CDF 4	61	11400	-17	8	3600	3100	$35	2,300,000	7
CDF 5	36	6600	-14	8	700	2400	$7	1,200,000	3
CDF 6	37	5200	-21	10	3900	3100	$61	1,600,000	5
CDF 7	93	8100	-34	20	8100	8400	$215	6,900,000	20
CDF 8	63	6700	-30	20	4400	7200	$100	4,200,000	12
East 55th Street (LPP)	157	7900	-22	10	7900	NA**	$246	6,850,000	20

***Based on 338,220 cubic yard annual disposal rate.**

****Cell 1 cross section for Alternatives 2a and 3a and the East 55th Street (LPP) includes both rubblemound and vertical steel sheet pile dikes (all other CDF alternatives are exclusively rubblemound; does not allow for equal comparison).**

(Note: the cost estimates date from June of 2007, and were based on a readily availability source of quarry stone – which is unlikely. These costs are "preliminary costs" and are presented in the table for comparison purposes only).

A. Preliminary Screening Of Management Measures

1. Comparing Measures to Objectives – A description of the evaluation process used to determine which measures would be carried into detailed planning starts in Section 2.37 of the Main report. The 24 measures identified in Table 2 were compared to the Planning Objectives (Section 2.09 of the main report) developed for this DMMP. A summary of this comparison was provided in Table 2.2 of the main report.

B. Measures Carried Into Detailed Planning

The Cleveland Harbor DMMP identified seven measures, including the No Action, which would be carried into detailed planning. A description of these seven measures follows.

1. Measure A- No Action Under this measure, the Federal Government would do nothing to address the need for future long term placement of dredged material. All USACE CDFs are essentially filled after the 2008 dredging season, given their current configurations. Consequently, all federal action at Cleveland would cease after 2008. There would be no dredging, no breakwater maintenance, no CDF maintenance and no CDF management. (Note: the No Action plan is essentially the Without Project Condition). Without dredging, the navigation channels would progressively shoal in and would result in reduced channel depths for commercial vessels. Reduced channel depths would result in light loading commercial navigation vessels over the 20-year evaluation period. Significant savings would be realized in the Federal budget as expenditures for operating and maintaining the Federal navigation project at Cleveland Harbor would no longer be required. Consistent with USACE guidance (ER 1105-2-100) this measure will be carried forward into detailed planning and fully evaluated in the array of final plans.

2. Measure 12- D1-New CDF- Inner Harbor-Site 9- E 55th The East 55th Street CDF would be approximately 157 acres, provide 6.9 million cubic yards of capacity for an estimated 20 year lifespan. It met various planning objectives and did not have to be combined with other sites to provide 20 years of capacity. Therefore, the E. 55th Street CDF location will be carried forward to detailed planning.

3. Measure 14- Measure D2-New CDF- Outer Harbor Offshore-Site 2- Site 2 is located along and lakeward of the West Breakwater. The site is 108 acres in size, provides 7.2 million cubic yards of storage and has a lifespan of 21.3 years. It met various plan evaluation objectives, and did not have to be combined with other sites to provide 20 years of capacity.

4. Measure 15- Measure D2-New CDF- Outer Harbor Offshore-Site 2a- Site 2a would involve the construction of a two celled CDF, one cell located lakeward and one cell located landward of the West Breakwater. Site 2a has a total size of 130 acres, provides 7.4 million cubic yards of space and has a lifespan of 21.8 years. It met various plan evaluation objectives, and did not have to be combined with other sites to provide 20 years of capacity.

5. Measure 16- Measure D2-New CDF- Outer Harbor Offshore-Site 3- Site 3 is located along and lakeward of the western end of the East Breakwater. The site is 117 acres in size, provides 7.2 million cubic yards of storage and has a lifespan of 21.3 years. It met various plan evaluation objectives, and did not have to be combined with other sites to provide 20 years of capacity.

6. Measure 17- Measure D2-New CDF- Outer Harbor Offshore-Site 3a- Site 3a would involve the construction of a two celled CDF, one cell located lakeward and one cell located landward of the East Breakwater. Site 3a has a total size of 123 acres, provides 6.5 million cubic yards of space and has a lifespan of 20 years. It met various plan evaluation objectives, and did not have to be combined with other sites to provide 20 years of capacity.

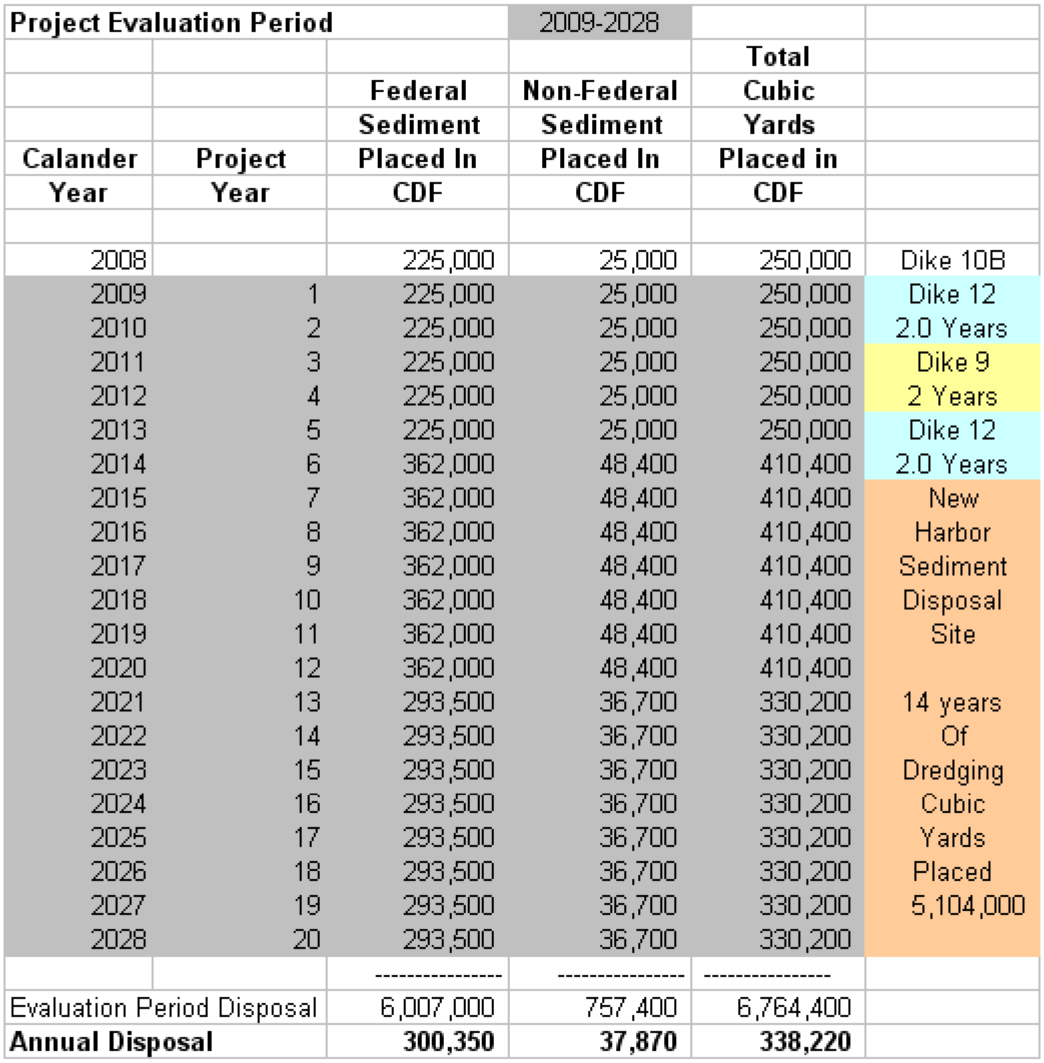
7. Measure 19- Measure E-Existing CDF Management The dredging cycles for Cleveland Harbor over the project evaluation period take place yearly from 2009 to 2028. Channel maintenance of Cleveland Harbor necessitates the removal of approximately 338,220 cubic yards annually.

One method to continue disposal at existing Cleveland Harbor CDFs is to grade the in-place sediment to generate additional space. Dry sediment within the CDF is harvested to raise the perimeter elevations, thus increasing capacity of the facility. In addition to the increased height of the perimeter, the area where sediment was harvested is now available for disposal of dredged material. Sediment used to raise the perimeter is graded to a specific slope and elevation to maximize design capacity and meet design criteria. Trenches are dug to dewater the sediment more quickly and maximize sediment compaction.

Consequently, CDF Management Plans (Best Operational Management Practices-BOMPs) were developed for CDFs 10B, 12 and 9. The implementation of these CDF management plans will allow channel maintenance dredging to continue 2014. The use of BOMPs at existing CDFs for the six year period 2009-2014 will allow sufficient time for the planning, design and construction of a new CDF and/or development of a new alternative for dredged material disposal at Cleveland. In 2015 a new disposal site will come on line to handle sediment dredged from 2015-2028, the remaining years in the project evaluation period. A brief description of the CDF management plans for CDFs 10B, 12 and 9 follows.

a. Sediment Dredging Schedule Due to the current CDF capacity shortage, dredging will be reduced to 250,000 cubic yards per year (225,000 cubic yards Federal and 25,000 cubic yards non-Federal) from 2008 through 2013 (Table 4).

Table 4. Cleveland Harbor Sediment Dredging Schedule-2009- 2028



Project Evaluation Period			2009-2028		
Calander Year	Project Year	Federal Sediment Placed In CDF	Non-Federal Sediment Placed In CDF	Total Cubic Yards Placed in CDF	
2008		225,000	25,000	250,000	Dike 10B
2009	1	225,000	25,000	250,000	Dike 12
2010	2	225,000	25,000	250,000	2.0 Years
2011	3	225,000	25,000	250,000	Dike 9
2012	4	225,000	25,000	250,000	2 Years
2013	5	225,000	25,000	250,000	Dike 12
2014	6	362,000	48,400	410,400	2.0 Years
2015	7	362,000	48,400	410,400	New
2016	8	362,000	48,400	410,400	Harbor
2017	9	362,000	48,400	410,400	Sediment
2018	10	362,000	48,400	410,400	Disposal
2019	11	362,000	48,400	410,400	Site
2020	12	362,000	48,400	410,400	
2021	13	293,500	36,700	330,200	14 years
2022	14	293,500	36,700	330,200	Of
2023	15	293,500	36,700	330,200	Dredging
2024	16	293,500	36,700	330,200	Cubic
2025	17	293,500	36,700	330,200	Yards
2026	18	293,500	36,700	330,200	Placed
2027	19	293,500	36,700	330,200	5,104,000
2028	20	293,500	36,700	330,200	
		---------------	---------------	---------------	
Evaluation Period Disposal		6,007,000	757,400	6,764,400	
Annual Disposal		**300,350**	**37,870**	**338,220**	

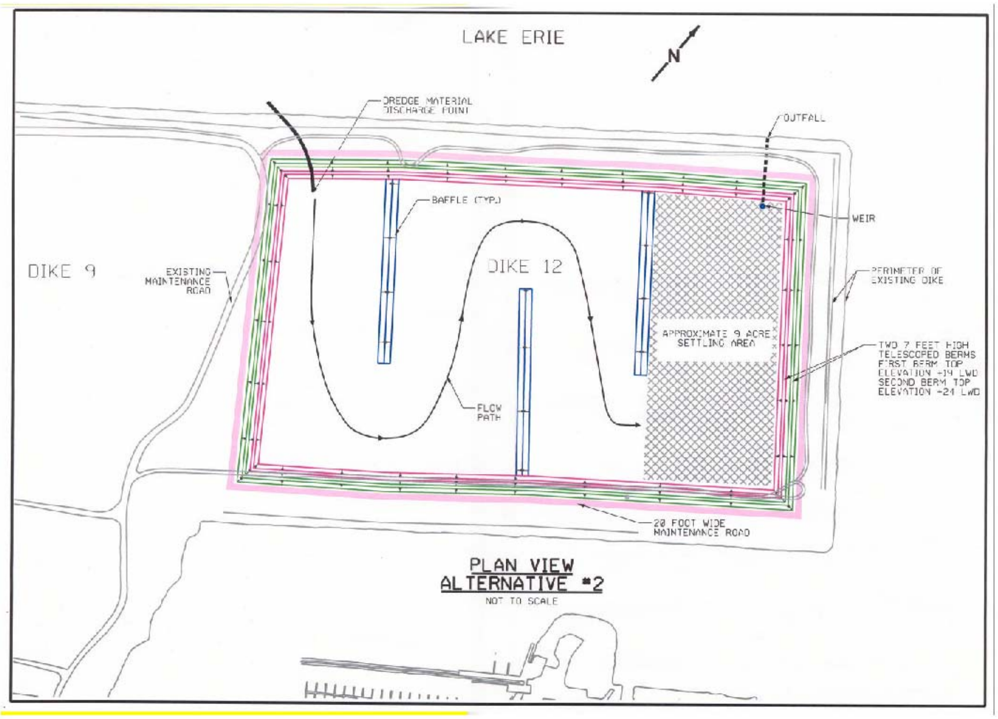
Dredging quantities would likely increase in 2014 to remove accumulated sediments (410,400 annually). Once the backlog has been removed (2020), annual dredging quantities will revert back to 330,200 cubic yards (2021-2028). This will result in approximately 338,220 cubic yards dredged annually during the twenty year study period. All sediment dredged from Cleveland Harbor will be placed in a CDF. Approximately 6,764,400 cubic yards of sediment will be removed from Cleveland Harbor over the twenty year evaluation period.

b. CDF Management Plan for CDF 10B. Since 1998, all sediment dredged at Cleveland Harbor have been deposited in CDF 10B. After dredging in 2005, CDF 10B was nearly filled with enough remaining capacity for a reduced dredging cycle in 2006. Prior to the 2006 dredging season, USACE implemented Phase I of the Fill Management Plan (FMP) and raised the southern perimeter of the CDF by constructing a gradual northward slope with existing dredge material within the CDF. In 2007, Phase II was implemented to allow for another two seasons (2007, 2008) of reduced dredging and disposal activities.

<u>c. CDF Management Plan for CDF 12</u> CDF 12 is located adjacent to Burke Lakefront (BKL) Airport. Any modifications to CDF 12 will consider the operational requirements of BKL Airport and comply with Federal Aviation Administration (FAA) regulations. FAA regulations limit the height and slope of the CDF perimeter. USACE has developed FMPs to maximize the capacity of existing CDFs while maintaining compliance with FAA regulations.

A two-phase FMP has been developed for CDF 12 to accommodate approximately four dredging cycles (2009 through 2010 for Phase 1 and 2013 through 2014 for Phase 2) (Figure 7). The proposed two-phased FMP at CDF 12 involves phased grading to create two 6-foot perimeter lifts (i.e., berms) using existing dredge material from the CDF. The top elevation of the first lift/berm (Phase 1) is at +18 LWD.

Figure 7. - Fill Management Plan (FMP)-CDF 12



The second lift/berm (Phase 2) shall be graded to +24 LWD after the CDF has reached the capacity provided by the first phase of work. A minimum two-foot freeboard shall be maintained over the entire area. The FMP was also designed to reduce the area of open water in the CDF to inhibit waterfowl nesting, foraging, and loafing. The FMP will be developed and implemented in stages, dependent on funding, design issues and scheduling/ coordination with dredging operations. Construction of the first phase of this FMP will be completed in FY09. Construction of the second phase of the FMP should be complete in FY13 and will be used to receive material in 2013 and 2014.

d. CDF Management Plan for CDF 9 Cleveland Harbor CDF 9 is a 21-acre facility. Proposed berms will be constructed around the CDF (2011) using re-graded sediment currently within the CDF. The berms will tie into both CDF 10B and CDF 12 berms on the west and east sides of the CDF, respectively. This will essentially create one large CDF to allow for more effective material deposition, decanting, and dewatering. Proposed elevations of the berms are to be approximately 587.2 feet above MWL. Some changes to the CDFs design are anticipated as coordination with the Cleveland Port Authority, a major stakeholder, continues to devise a plan to avoid disruption of the Burke Lakefront Airport Instrument Landing System (ILS) and weather station. Planned use of CDF 9 is in 2011 and 2012.

The USACE, Buffalo District has constructed a number of in-lake CDFs that have been filled or are essentially filled. These facilities can and have been managed to extend their useful life to accept dredged materials. Such measures typically involve construction of interior berms with sandy dredged material to increase the capacity of the CDF, as described above. These measures are extremely cost effective in that they utilize existing CDF footprints.

III. PLANS DEVELOPED AND EVALUATED IN DETAIL-COMPONENTS

The seven measures carried forward to detailed planning were used to develop a range of plans that would allow the harbor to be maintained over the 20 year evaluation period 2009-2028. Seven plans were developed using these seven measures. These seven Plans are:

- Alternative Plan 1 – No Action
- Alternative Plan 2 – Management of Existing CDFs and Construction of CDF 2
- Alternative Plan 2a – Management of Existing CDFs and Construction of CDF 2a
- Alternative Plan 3 – Management of Existing CDFs and Construction of CDF 3
- Alternative Plan 3a - Management of Existing CDFs and Construction of CDF 3a
- Alternative Plan 4 – Management of Existing CDFs and Construction of new CDF at the foot of East 55th Street, Corps Configuration
- Alternative Plan 4a- Management of Existing CDFs and Construction of new CDF at the foot of East 55th Street, Locals Configuration.

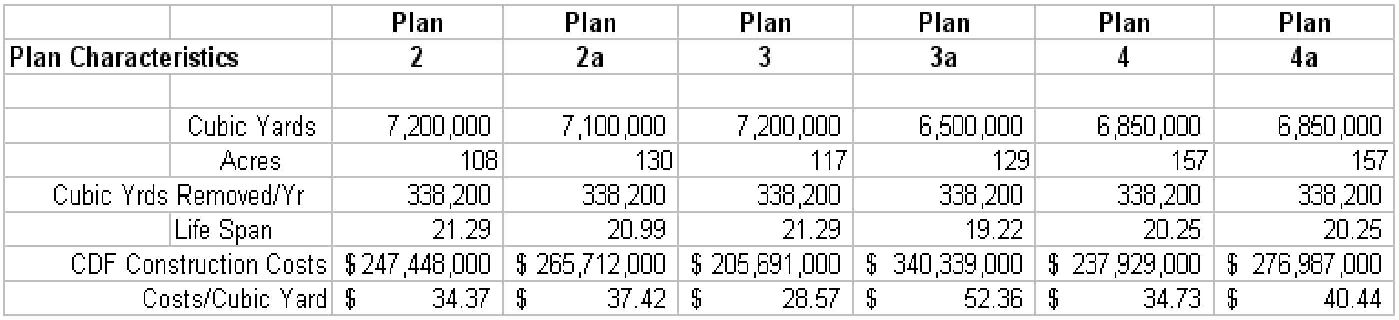
These plans are presented in detail in the main report. Table 5 provides the various components of the seven alternative plans. Plans 2 through 4a have a common component: a FMP for CDFs 12 and 9. Implementation of the FMP component at the existing outer Harbor CDFs will allow sufficient time for planning and construction of a new CDF, which is an integral part of Plans 2-4a. Table 5 also provides some general plan characteristics such as cubic capacity, acres, average cubic yards removed per year, lifespan, CDF construction costs, and costs per cubic yard based on construction costs.

Table 5- Cleveland DMMP Plan Components/General Characteristics

A. Plan Components

Alternative Plans	**Management Measures**		
	(A)	**(D)**	**(E)**
	No Action	**New CDF**	**Fill Mgmt Plan at Existing CDFs**
Alternative Plan 1 No Action	**X**		
Alternative Plan 2- New CDF- Site 2		**X**	**X**
Alternative Plan 2a New CDF-Site 2a		**X**	**X**
Alternative Plan 3 New CDF-Site 3		**X**	**X**
Alternative Plan 3a New CDF-Site 3a		**X**	**X**
Alternative Plan 4 New CDF-E55th St Corps Configuration		**X**	**X**
Alternative Plan 4a New CDF-E55th St Locals Configuration		**X**	**X**

B. General Plan Characteristics



Plan Characteristics	Plan 2	Plan 2a	Plan 3	Plan 3a	Plan 4	Plan 4a
Cubic Yards	7,200,000	7,100,000	7,200,000	6,500,000	6,850,000	6,850,000
Acres	108	130	117	129	157	157
Cubic Yrds Removed/Yr	338,200	338,200	338,200	338,200	338,200	338,200
Life Span	21.29	20.99	21.29	19.22	20.25	20.25
CDF Construction Costs	$ 247,448,000	$ 265,712,000	$ 205,691,000	$ 340,339,000	$ 237,929,000	$ 276,987,000
Costs/Cubic Yard	$ 34.37	$ 37.42	$ 28.57	$ 52.36	$ 34.73	$ 40.44

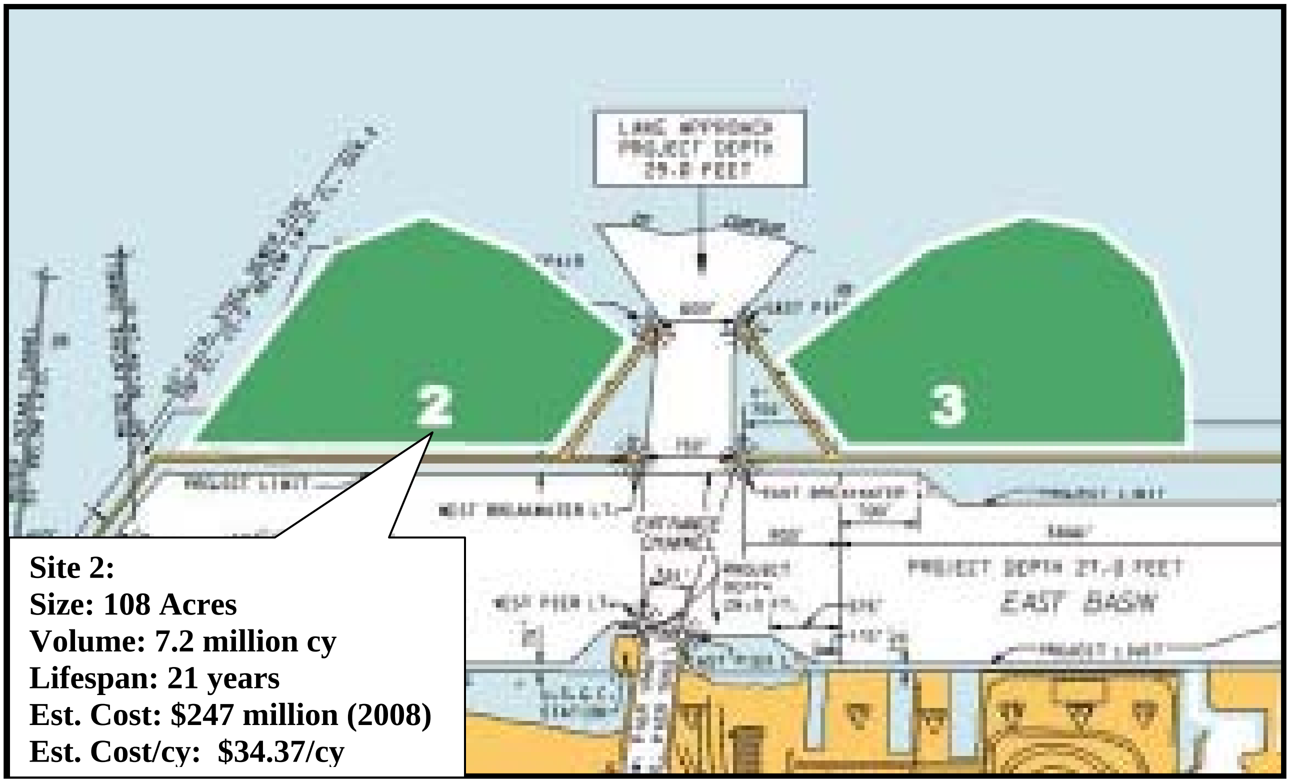
A. Alternative Plan 1-No Action

The No Action Plan implies that no short term or long term measure for management of dredged material from Cleveland Harbor will be undertaken during the planning evaluation period (2009-2028). Under the No Action plan, all expenditures associated with dredging would cease in project year one, 2009. Future sediments deposited in commercial navigation channels from shoaling over the twenty year evaluation period (2009-2028) would not be dredged and would result in reduced channel depths for commercial vessels. Again, since dredging would cease in project year 1, there would also be no FMP costs during the project evaluation period.

B. Alternative Plan 2-New CDF- Site 2

Alternative Plan 2 includes implementation of the FMP from 2009 through 2014 at CDF 12 and 9 and construction of a new CDF at Site 2. Site 2 is located along and lakeward of the West Breakwater. Implementation of the FMP component at existing Cleveland Harbor CDFs will allow sufficient time for planning and construction of the new CDF. CDF 2 is 108 acres in size and is in about 34 feet of water (Figure 8). The capacity of CDF 2 is around 7,200,000 cubic yards.

Figure 8.- Location Of Plan 2- New CDF- Site 2



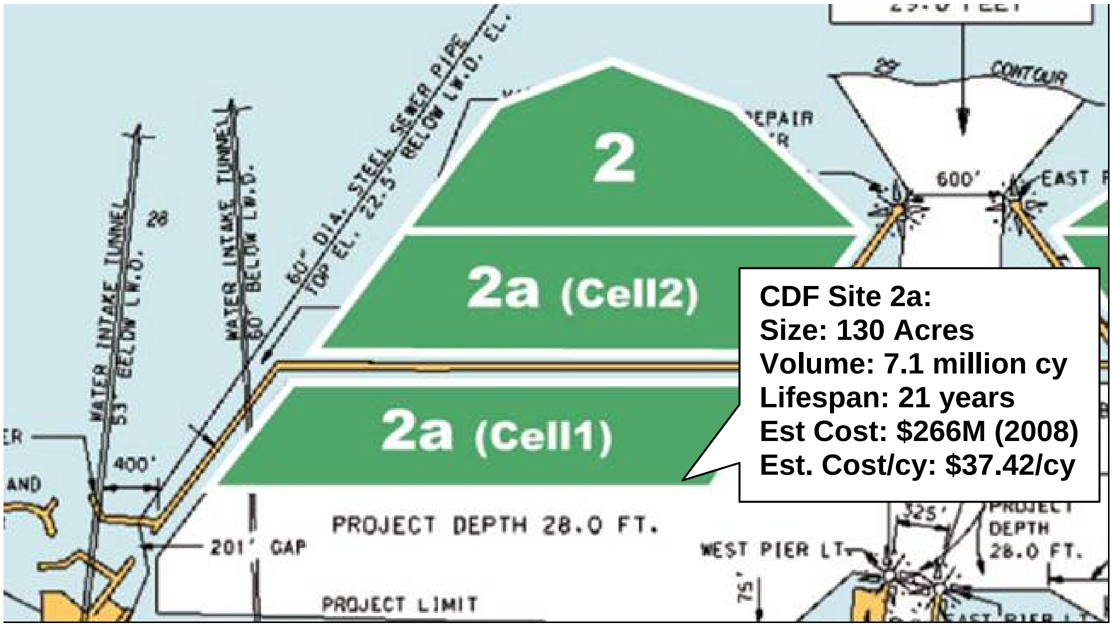
Site 2:
Size: 108 Acres
Volume: 7.2 million cy
Lifespan: 21 years
Est. Cost: $247 million (2008)
Est. Cost/cy: $34.37/cy

Implementation costs associated with Plan 2 include CDF management costs, dredging costs, fish habitat development and new CDF construction costs. CDF management costs for Plan 2 include CDF management costs for CDF 12 and CDF 9. CDF management costs associated with CDF 12 are approximately $4,818,000. This money would be expended evenly in 2009 and 2013. Management costs associated with CDF 9 are approximately $2,409,000. This money would be expended in 2011. Costs associated with putting the sediments into existing Cleveland Harbor CDFs from 2009-2014 range from $1,674,100 to $2,520,200 per dredging event. Cost associated with putting the sediments into the new CDF (2015-2028) range from $2,287,100 to $2,739,200 per dredging event. The plan also includes the development of fish spawning habitat along the CDFs ($500,000). Rubble mound construction of the new CDF would take place in approximately 34 feet of water, be constructed over a three year period (2012, 2013, 2014), and cost $247,448,000.

C. Alternative Plan 2a-New CDF- Site 2a

Plan 2a includes implementation of the FMP from 2009 through 2014 at CDF 12 and 9 and construction of a new two celled CDF at Site 2a on the West Breakwater. One cell would be located lakeward and one cell located landward of the West Breakwater. Site 2a has a total size of 130 acres, provides 7.1 million cubic yards of space, has a lifespan of 21 years and a construction cost of $265,712,000 (Figure 9).

Figure 9. Location of Plan 2a- New CDF- Site 2a



CDF Site 2a:
Size: 130 Acres
Volume: 7.1 million cy
Lifespan: 21 years
Est Cost: $266M (2008)
Est. Cost/cy: $37.42/cy

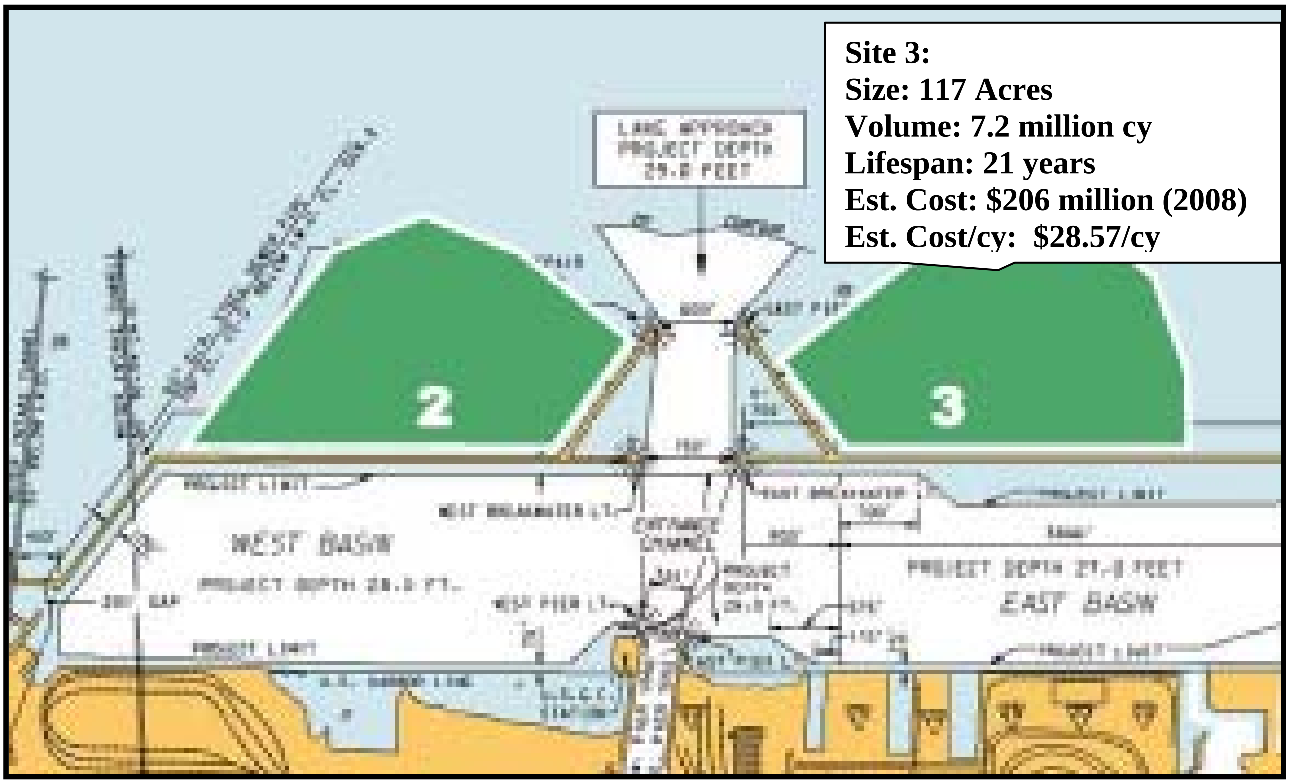
Cell 1, to be constructed and available for disposal of dredged material in 2015, would be approximately 65 acres in size. Construction of cell 1 would include the existing wall of the West Breakwater as the northern perimeter. To the east and south, cell 1 would be constructed of new perimeter walls, consisting of steel sheet pile construction. This cell would be subdivided as necessary to improve the operational aspects of dredged material disposal. Cell 1 would be designed to have a life of about eight years assuming the average annual disposal of about 390,000 cubic yards during this time (about 3,122,800 cubic yards total). Cell 1 would be operational from 2015 through 2022. Upon filling cell 1 the area would be transferred to the local sponsor. Cell 2 of alternative plan 2a would be constructed to include the West Breakwater as the southerly wall and would be operational from 2023 through 2034. It would be designed to have an estimated capacity of 4.1 million cubic yards for a life of twelve years at 338,200 cubic yards per year. The north wall of cell 2 would probably be constructed of stone to deflect wave action present in this unprotected area. Implementation of Alternative Plan 2a would require de-authorization of the rarely used and rarely dredged portion of the harbor encroached upon by Cell 1 of the CDF.

Implementation costs associated with Plan 2a include CDF management costs, dredging costs, fish habitat development and new CDF construction costs. CDF management costs for Plan 2a include CDF management costs for CDF 12 and CDF 9. CDF management costs associated with CDF 12 are approximately $4,818,000. This money would be expended evenly in 2009 and 2013. Management costs associated with CDF 9 are approximately $2,409,000. This money would be expended in 2011. Costs associated with putting the sediments into existing Cleveland Harbor CDFs from 2009-2014 range from $1,674,100 to $2,520,200 per dredging event. Cost associated with putting the sediments into the new CDF at Cell 1 (2015-2022) range from $1,948,100 to $2,321,100 per dredging event. Cost associated with putting the sediments into the new CDF at Cell 2 (2023-2028) range from $1,948,100 to $2,287,100 per dredging event. The plan also includes the development of fish spawning habitat along the outside of new and existing CDFs ($500,000). Rubble mound construction of Cell 1 would take place in approximately 28 feet of water, be constructed over a three year period (2012, 2013, 2014), and cost $119,913,000. Rubblemound construction of Cell 2 would take place in approximately 32 feet of water, be constructed over a three year period (2020, 2021, 2022), and cost $145,799,000.

D. Alternative Plan 3-New CDF- Site 3

Alternative Plan 3 includes implementation of the FMP from 2009 through 2014 at CDF 12 and 9 and building a new CDF at Site 3. Site 3- is located along and lakeward of the western end of the East Breakwater. The site is 117 acres in size, provides 7.2 million cubic yards of storage and has a lifespan of 21 years. Figure 10 provides a schematic of the CDF location and layout.

Figure 10. Location of Plan 3- New CDF- Site 3



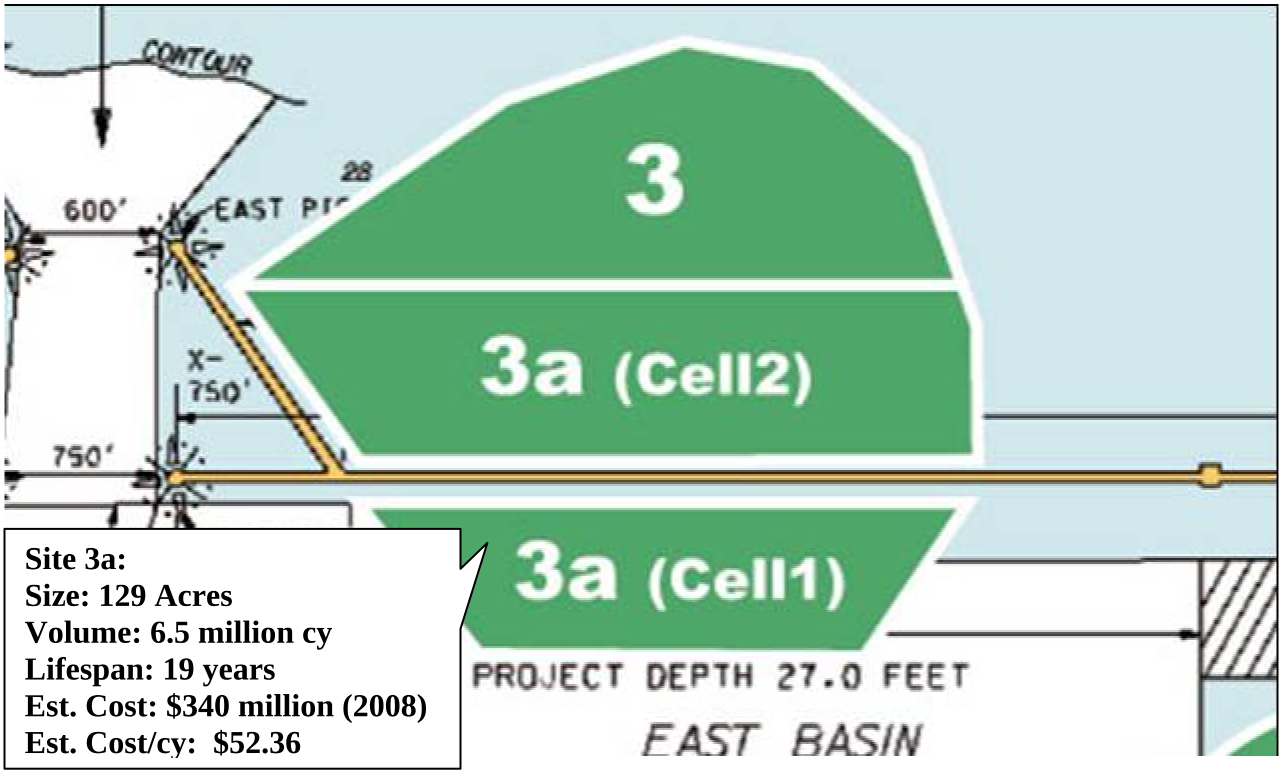
Site 3:
Size: 117 Acres
Volume: 7.2 million cy
Lifespan: 21 years
Est. Cost: $206 million (2008)
Est. Cost/cy: $28.57/cy

Implementation costs associated with Plan 3 include CDF management costs, dredging costs, fish habitat development and new CDF construction costs. CDF management costs for Plan 3 include CDF management costs for CDF 12 and CDF 9. CDF management costs associated with CDF 12 are approximately $4,818,000. This money would be expended evenly in 2009 and 2013. Management costs associated with CDF 9 are approximately $2,409,000. This money would be expended evenly in 2011. Costs associated with putting the sediments into existing Cleveland Harbor CDFs from 2009-2014 range from $1,674,100 to $2,520,200 per dredging event. Cost associated with putting the sediments into the new CDF (2015-2028) range from $2,287,100 to $2,739,200 per dredging event. The plan also includes the development of fish spawning habitat along the CDFs ($500,000). Rubble mound construction of the new CDF would take place in approximately 34 feet of water, be constructed over a three year period (2012, 2013, 2014), and cost $205,691,000.

E. Alternative Plan 3a-New CDF- Site 3a

Alternative Plan 3a includes implementation of the FMP from 2009 through 2014 at CDF 12 and 9 and the construction of a two celled CDF at Site 3a, one cell located lakeward and one cell located landward of the East Breakwater (Figure 11). Site 3a has a total size of 129 acres, provides 6.5 million cubic yards of space, has a 19 year lifespan, and construction costs of $340,339,000. Site 3a would be similar in configuration to that presented for Alternative Plan 2a.

Figure 11. Location of Plan 3a- New CDF- Site 3a



Site 3a:
Size: 129 Acres
Volume: 6.5 million cy
Lifespan: 19 years
Est. Cost: $340 million (2008)
Est. Cost/cy: $52.36

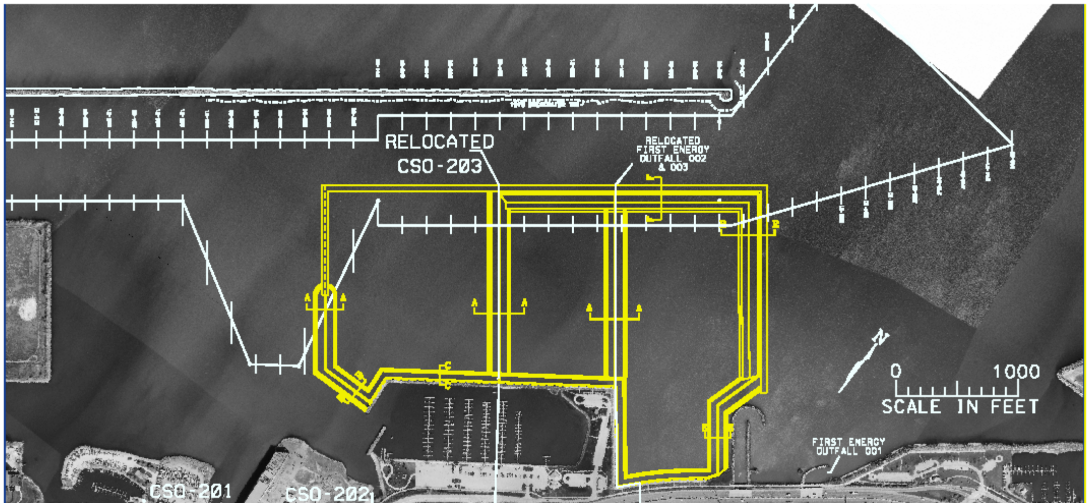
The relationship between Alternative 3 and 3a is analogous to that of 2 and 2a. The primary difference is that Alternative 3a will be constructed in shallower water depths which will reduce construction costs on a per lineal foot basis. Cell 1, to be constructed and available for disposal of dredged material in 2015, would be approximately 75 acres in size. Construction of cell 1 would include the existing wall of the East Breakwater as the northern perimeter. To the east, south, and west, cell 1 would be constructed of new perimeter walls, consisting of steel sheet pile construction. This cell would be subdivided as necessary to improve the operational aspects of dredged material disposal. Cell 1 would be designed to have a life of about five years assuming the average annual disposal of about 410,000 cubic yards (about 2,000,000 cubic yards total). Cell 1 would be operational from 2015 through 2019. Upon filling cell 1 the area would be transferred to the local sponsor. Cell 2 of alternative plan 3a would be constructed to include the East Breakwater as the southerly wall and would be operational from 2020 through 2034. It would be designed to have an estimated capacity of 4,300,000 cubic yards for a life of thirteen years at 338,200 cubic yards per year. The north wall of cell 2 would probably be constructed of stone to deflect wave action present in this unprotected area. Implementation of Alternative Plan 3a would require de-authorization of the rarely used and rarely dredged portion of the harbor encroached upon by Cell 1 of the CDF.

Implementation costs associated with Plan 3a include CDF management costs, dredging costs, fish habitat development and new CDF construction costs. CDF management costs for Plan 3a include CDF management costs for CDF 12 and CDF 9. CDF management costs associated with CDF 12 are approximately $4,818,000. This money would be expended evenly in 2009 and 2013. Management costs associated with CDF 9 are approximately $2,409,000. This money would be expended in 2011. Costs associated with putting the sediments into existing Cleveland Harbor CDFs from 2009-2014 range from $1,674,100 to $2,520,200 per dredging event. Cost associated with putting the sediments into the new CDF at Cell 1 (2015-2019) are $2,360,900 per dredging event. Cost associated with putting the sediments into the new CDF at Cell 2 (2020-2028) range from $1,980,400 to $2,360,900 per dredging event. The plan also includes the development of fish spawning habitat along the CDFs ($500,000). Rubble mound construction of Cell 1 would take place in approximately 28 feet of water, be constructed over a three year period (2012, 2013, 2014), and cost $138,789,000. Rubblemound construction of Cell 2 would take place in approximately 32 feet of water, be constructed over a three year period (2017, 2018, 2019), and cost $201,550,000.

F. Alternative Plan 4-New CDF- East 55th Street-Corps Configuration

Alternative Plan 4 includes implementation of the FMP from 2009 through 2014 at CDF 12 and 9 and the construction of CDF 9 (East 55th Street CDF). This plan would involve the construction of a CDF at the East 55th St. site (three cells) as illustrated in Figure 12 below. The CDF is approximately 157 acres in size, provides 6,850,000 cubic yards of capacity and has a 20 year life span.

Figure 12. Location of Plan 4- New CDF- Site 9- E. 55th Street



To the south, the East 55th Street site will be bounded by an improved State Park Marina breakwater, the natural shoreline near the terminus of East 55th Street, and a to-be-constructed perimeter wall/dike. A portion of the eastern boundary would be formed by the existing First Energy circulating water intake (necessary improvements will be made to the structure) and the remainder of the perimeter shown will be formed by still to be constructed walls. The perimeter walls will be back to back open cell construction. The CDF will be constructed in optimally sized cells in order to spread out construction costs over time while still maintaining cost effectiveness. Three individual cells will be constructed. The combined footprint will not exceed what is shown in Figure 12. The entire facility provides 20 years of capacity assuming an annual dredging volume of about 338,220 cubic yards per year. The first cell would be constructed from 2012 through 2014, allowing filling operations to begin in FY15.

The proposed footprint of the East 55th Street site encroaches on the existing Federal approach channel in the east basin and eastern flared portion of the 25-foot deep dock approach channel to the former Nicholson Cleveland Terminal Company pier. These portions of the existing project were authorized but never constructed. These portions of the channel must be de-authorized in order to implement the proposed East 55th Street CDF alternative.

Implementation costs associated with Plan 4 include CDF management costs, dredging costs, water outfall relocation costs, fish habitat development and new CDF construction costs. CDF management costs for Plan 4 include CDF management costs for CDF 12 and CDF 9. CDF management costs associated with CDF 12 are approximately $4,818,000. This money would be expended evenly in 2009 and 2013. Management costs associated with CDF 9 are approximately $2,409,000. This money would be expended in 2011. Costs associated with putting the sediments into existing Cleveland Harbor CDFs from 2009-2014 range from $1,674,100 to $2,520,200 per dredging event. Cost associated with putting sediments into the new CDF at Cell 1 (2015-2021) range from $2,174,100 to $2,599,800 per dredging event. Cost associated with putting the sediments into the new CDF at Cell 2 (2022-2026) range from $2,141,800 to $2,174,100 per dredging event. Cost associated with putting the sediments into the new CDF at Cell 3 (2027-2034) are $2,141,800.

There are two water outfalls (a 42 inch diameter and a 14 foot diameter outfall) that will have to be extended approximately 1,000 feet. Extension of these outfalls have a total cost $7,591,500 and would take place in two stages. The first extension would start in 2014 ($5,091,491) and the second extension ($2,500,000) in 2021. The plan also includes the development of fish spawning habitat along the CDFs ($500,000).

Construction costs for Plan 4 are $237,929,000. Construction of Cell 1 would take place in approximately 25 feet of water, be constructed over a three year period (2012, 2013, 2014), and cost $110,450,000. Construction of Cell 2 would take place in approximately 28 feet of water, be constructed over a three year period (2019, 2020, 2021), and cost $54,091,000. Construction of Cell 3 would take place in approximately 28 feet of water, be constructed over a three year period (2024, 2025, 2026), and cost $73,388,000.

G. Alternative Plan 4a-New CDF- East 55th Street-Local Configuration

This plan would be identical in acreage and capacity as Plan 4. However, the vertical perimeter walls would be required to accommodate possible future development activities on the CDF. The engineering components of the steel sheet pile (i.e. vertical and lateral strength) would thus be greater than that used to construct Alternative Plan 4. The CDF would be 157 acres in size, provide 6,850,000 cubic yards of sediment capacity and have a 20 year life span.

The CDF will be constructed in optimally sized cells in order to spread out construction costs over time while still maintaining cost effectiveness. Three individual cells will be constructed. The proposed footprint of the East 55th Street site encroaches on the existing Federal approach channel in the east basin and eastern flared portion of the 25-foot deep dock approach channel to the former Nicholson Cleveland Terminal Company pier. These portions of the existing project were authorized but never constructed. These portions of the channel must be de-authorized in order to implement the proposed East 55th Street CDF alternative.

Implementation costs associated with Plan 4a include CDF management costs, dredging costs, water outfall relocation costs, fish habitat development, and new CDF construction costs. CDF management costs for Plan 4a include CDF management costs for CDF 12 and CDF 9. CDF management costs associated with CDF 12 are approximately $4,818,000. This money would be expended evenly in 2009 and 2013. Management costs associated with CDF 9 are approximately $2,409,000. This money would be expended in 2011. Costs associated with putting the sediments into existing Cleveland Harbor CDFs from 2009-2014 range from $1,674,100 to $2,520,200 per dredging event. Cost associated with putting sediments into the new CDF at Cell 1 (2015-2021) range from $2,174,100 to $2,599,800 per dredging event. Cost associated with putting the sediments into the new CDF at Cell 2 (2022-2026) range from $2,141,800 to $2,174,100 per dredging event. Cost associated with putting the sediments into the new CDF at Cell 3 (2027-2034) are $2,141,800.

There are two water outfalls (a 42 inch diameter and a 14 foot diameter outfall) that will have to be extended approximately 1,000 feet. Extension of these outfalls have a total cost $6,520,300 and would take place in two stages. The first extension would start in 2014 ($4,077,100) and the second extension ($2,443,200) in 2021. The plan also includes the development of fish spawning habitat along the outside of new and existing CDFs ($500,000).

Construction costs for Plan 4a are $276,987,000. Construction of Cell 1 would take place in approximately 25 feet of water, be constructed over a three year period (2012, 2013, 2014), and cost $129,667,000. Construction of Cell 2 would take place in approximately 28 feet of water, be constructed over a three year period (2019, 2020, 2021), and cost $60,513,000. Construction of Cell 3 would take place in approximately 28 feet of water, be constructed over a three year period (2024, 2025, 2026), and cost $86,807,000.

H. Alternative Plan Dredging Costs

1. Introduction Dredging costs per dredging event were calculated for each alternative. There are a number of pieces of information that need to be known before dredging costs can be calculated. These include frequency of dredging, cubic yards removed per cycle, the quality of the sediments and location of disposal sites (CDF / Open Lake). Once this information is known, fixed and variable costs for dredging associated with the various plans, can be calculated.

2. Dredging Frequency, Cubic Yards Removed Per Dredging Event, Sediment Quality
The need for maintenance dredging arises from the buildup of shoal material in the navigation channels which leads to the restriction of the flow of commercial navigation. The need to dredge portions of the Outer harbor, Old River Channel, and Cuyahoga River depends upon the continued operation of the various docks that receive the major bulk commodities that use Cleveland Harbor: iron ore, limestone, cement and concrete, salt, and sand, gravel and crushed rock.

Cleveland Harbor is dredged annually in the spring and fall. Although Cleveland Harbor has dredging occurring twice in a given year, both dredging events are let under one contract and all dredging is performed by one dredge. Thus the harbor is said to be dredged annually. However, only the Cuyahoga River channel is dredged each year. The Old River and Outer Harbor, which experience much less shoaling than the Cuyahoga River, are dredged on average once every five years. All material dredged from Cleveland Harbor is deposited in a CDF.

There is an abundance of historic data on the volume of material removed from the harbor each year. The data indicate that on the average 273,500 cubic yards of material are dredged from the Cuyahoga River each year. In addition, on average 50,000 cubic yards are removed each time the Outer Harbor or the Old River channels are dredged. The latter two channels are dredged every fifth year. Therefore, together, they add, on a yearly average, an additional 20,000 cubic yards to the 273,500 cubic yards annually dredged from the Cuyahoga River. Thus in total, an average of 293,500 cubic yards of material are projected to be removed from Cleveland Harbor Federal channels each year. It is projected that this volume will be removed each year through the 20-year evaluation period.

Non-Federal dredging activities during this same time period resulted in an average of 36,700 cubic yards. Average total in place cubic yards removed (Federal and non-Federal) per dredging event for the time period 1998-2003 was 330,200 (Table 6).

Table 6.
Recent Dredging History (In Place Cubic Yards Per Year [1])

	Year 1998	Year 1999	Year 2000	Year 2001	Year 2002	Year 2003	Average	Disposal Site
Federal Dredging	335,900	281,700	225,600	401,800	182,000 [2]	333,900 [3]	293,500	CDF
Non Federal	24,700	25,100	107,400	23,700	11,800	27,600	36,700	CDF
Total Dredging	360,600	306,800	333,000	425,500	193,800	361,500	330,200	CDF

1. All volumes are "In Place" volumes.
2. Dredging operations were limited by available funds. Actual quantities dredged in 2002 do not necessarily reflect the required dredging volumes if sufficient O&M appropriations were available.
3. Preliminary estimate of in place Federal cubic yards dredged in 2003.

Given the reduction in operation and maintenance budgets in recent years, and the growing lack of space in existing CDFs for future dredging cycles, quantities dredged at Cleveland Harbor in recent years have been well below these historical volumes. The DMMP estimated how many cubic yards of sediment would need to be dredged yearly over the project evaluation period 2009-2028. Channel maintenance of Cleveland Harbor necessitates the removal of approximately 338,220 cubic yards annually.

Due to the current CDF capacity shortage, dredging will be reduced to 250,000 cubic yards per year (225,000 cubic yards Federal and 25,000 cubic yards non-Federal) from 2008 through 2013 (Table 6). Dredging quantities would likely increase in 2014 to remove accumulated sediments (410,400 annually). Once the initial backlog has been removed (2020), annual dredging quantities will revert back to 330,200 cubic yards annually (2021-2028). This will result in, approximately 338,220 cubic yards being dredged annually during the twenty year study period. Again, all sediment dredged from Cleveland Harbor will be placed in a CDF.

3. Dredging Costs Per Dredging Event- By Disposal Location The Project Management Team has provided the variable cost per cubic yard for placement of sediment at the current CDF site 10B: $5.25. These costs were then adjusted to reflect the increase/decrease in cycle times that would occur when using other CDF Disposal sites. Table 8 summarizes these dredging costs per cubic yard by CDF disposal site. Dredging costs per cubic yard for CDF located outside the Harbors breakwaters were higher than CDF 10B dredging costs. This is due to the increased wind and wave activity that would be encountered during dredging operations which would increase round trip dredge cycling times.

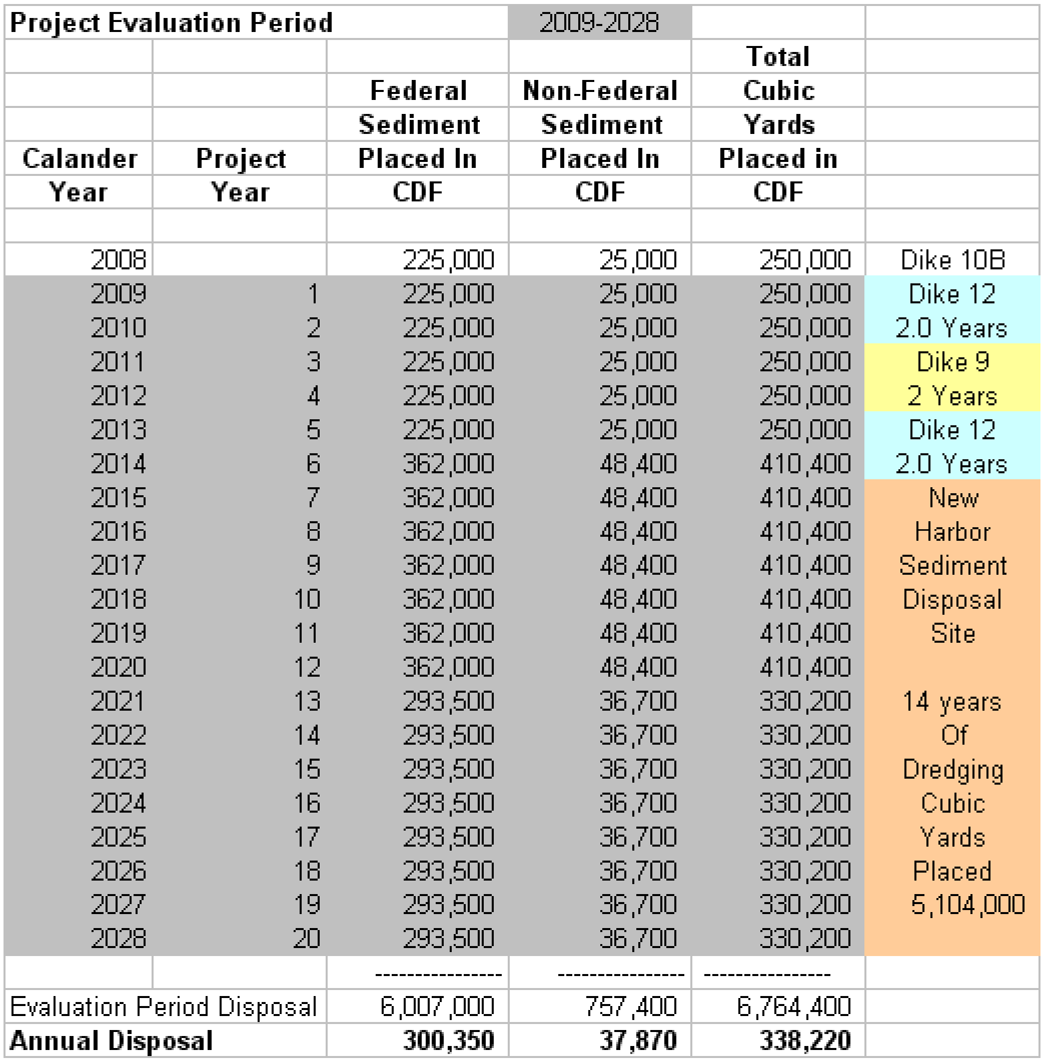
The cost of dredging at any one time is a function of the dredging event's variable and fixed costs. The variable costs of dredging are the product of an estimated cost per cubic yard of dredging by disposal site (Table 8), times the number of cubic yards removed that year (Table 7). Fixed costs consist of the "mobilization/demobilization cost for the dredge, and the cost the District incurs in engineering, administering and supervising the entire dredging project each time the harbor is dredged. For Cleveland Harbor the mobilization/demobilization cost is $300,000. Fixed costs per dredging event (Engineering and Design, Supervision and Administration)) are set to be $50,000 plus 10 percent of variable costs.

These dredging costs per cubic yard by disposal site were then used with cubic yards removed per year, to develop variable dredging costs per dredging event by disposal location. Added to these variable costs were fixed costs consisting of mobilization and demobilization costs, Engineering & Design (E&D) and Supervision and Administration (S&A). Table 9 provides a summary of dredging costs per cycle by cubic yards removed by disposal location.

For example, dredging costs associated with removing 225,000 cubic yards of sediment In 2009 and placing it in CDF 12 is $1,698,875. These costs consist of variable dredging costs ($5.45 per cubic yard x 225,000 cubic yards =$1,226,150) and fixed dredging costs ($300,000 for mobilization + $50,000+ 10 percent x $1,226,250=$472,625).

4. Time Stream Of Annual Dredging Costs By Alternative The cyclical dredging costs presented in Table 9, in conjunction with the dredging schedule presented in Table 7, were used to develop a time stream of dredging costs associated with each of the plans being evaluated in detail over the project evaluation period: 2009-2028. Table 10 presents the time stream of dredging costs associated with each plan being evaluated.

Table 7. Cleveland Harbor Sediment Dredging Schedule-2009- 2028



Project Evaluation Period			2009-2028		
Calander Year	Project Year	Federal Sediment Placed In CDF	Non-Federal Sediment Placed In CDF	Total Cubic Yards Placed in CDF	
2008		225,000	25,000	250,000	Dike 10B
2009	1	225,000	25,000	250,000	Dike 12
2010	2	225,000	25,000	250,000	2.0 Years
2011	3	225,000	25,000	250,000	Dike 9
2012	4	225,000	25,000	250,000	2 Years
2013	5	225,000	25,000	250,000	Dike 12
2014	6	362,000	48,400	410,400	2.0 Years
2015	7	362,000	48,400	410,400	New
2016	8	362,000	48,400	410,400	Harbor
2017	9	362,000	48,400	410,400	Sediment
2018	10	362,000	48,400	410,400	Disposal
2019	11	362,000	48,400	410,400	Site
2020	12	362,000	48,400	410,400	
2021	13	293,500	36,700	330,200	14 years
2022	14	293,500	36,700	330,200	Of
2023	15	293,500	36,700	330,200	Dredging
2024	16	293,500	36,700	330,200	Cubic
2025	17	293,500	36,700	330,200	Yards
2026	18	293,500	36,700	330,200	Placed
2027	19	293,500	36,700	330,200	5,104,000
2028	20	293,500	36,700	330,200	
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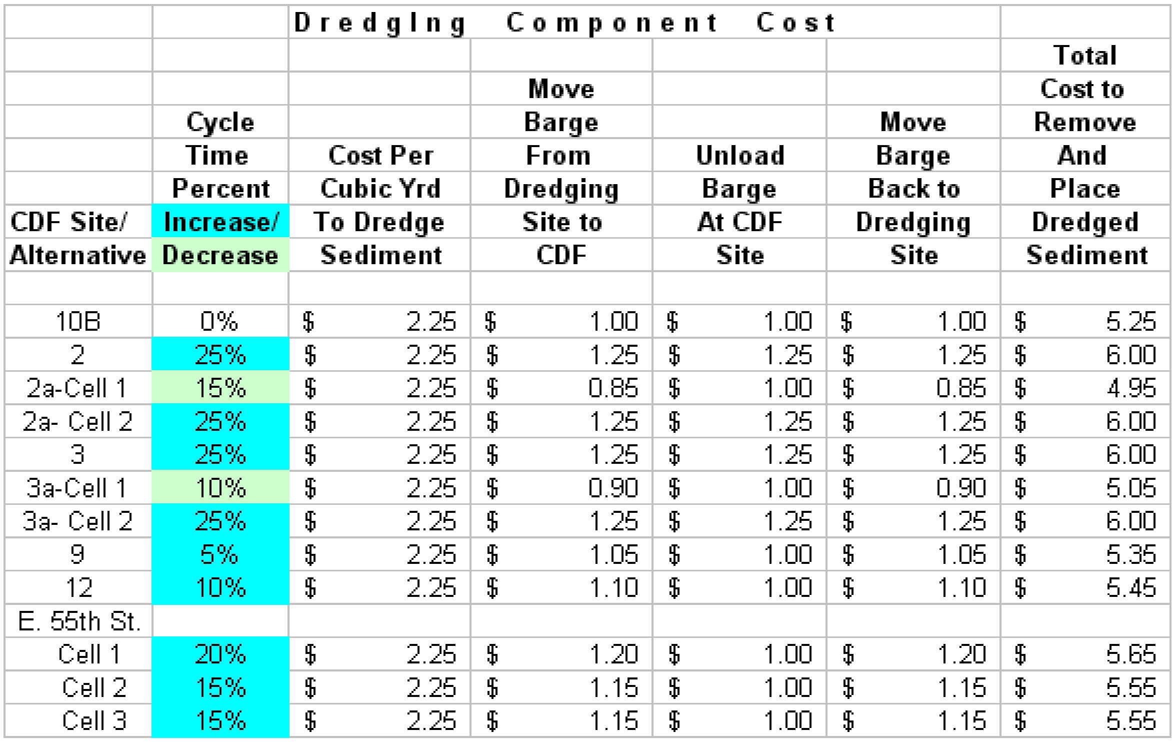
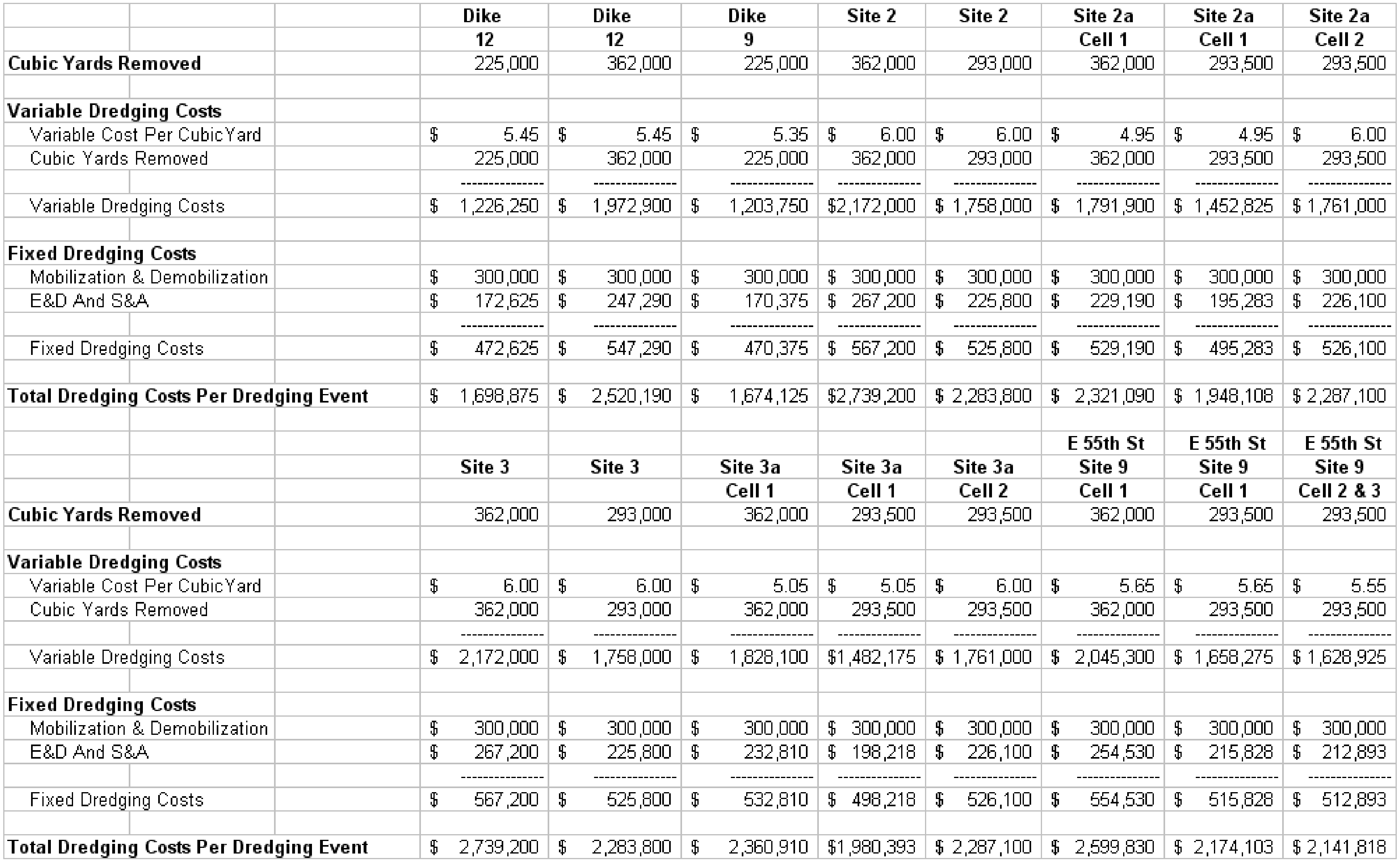
Evaluation Period Disposal		6,007,000	757,400	6,764,400	
Annual Disposal		**300,350**	**37,870**	**338,220**	

Table 8 Dredging Costs Per Cubic Yard By Disposal Site



		Dredging Component Cost				
CDF Site/ Alternative	Cycle Time Percent Increase/ Decrease	Cost Per Cubic Yrd To Dredge Sediment	Move Barge From Dredging Site to CDF	Unload Barge At CDF Site	Move Barge Back to Dredging Site	Total Cost to Remove And Place Dredged Sediment
10B	0%	$ 2.25	$ 1.00	$ 1.00	$ 1.00	$ 5.25
2	25%	$ 2.25	$ 1.25	$ 1.25	$ 1.25	$ 6.00
2a-Cell 1	15%	$ 2.25	$ 0.85	$ 1.00	$ 0.85	$ 4.95
2a- Cell 2	25%	$ 2.25	$ 1.25	$ 1.25	$ 1.25	$ 6.00
3	25%	$ 2.25	$ 1.25	$ 1.25	$ 1.25	$ 6.00
3a-Cell 1	10%	$ 2.25	$ 0.90	$ 1.00	$ 0.90	$ 5.05
3a- Cell 2	25%	$ 2.25	$ 1.25	$ 1.25	$ 1.25	$ 6.00
9	5%	$ 2.25	$ 1.05	$ 1.00	$ 1.05	$ 5.35
12	10%	$ 2.25	$ 1.10	$ 1.00	$ 1.10	$ 5.45
E. 55th St.						
Cell 1	20%	$ 2.25	$ 1.20	$ 1.00	$ 1.20	$ 5.65
Cell 2	15%	$ 2.25	$ 1.15	$ 1.00	$ 1.15	$ 5.55
Cell 3	15%	$ 2.25	$ 1.15	$ 1.00	$ 1.15	$ 5.55

Table 9 Summary of Dredging Costs Per Cycle, By Placement Location.



	Dike 12	Dike 12	Dike 9	Site 2	Site 2	Site 2a Cell 1	Site 2a Cell 1	Site 2a Cell 2
Cubic Yards Removed	225,000	362,000	225,000	362,000	293,000	362,000	293,500	293,500
Variable Dredging Costs								
Variable Cost Per Cubic Yard	$ 5.45	$ 5.45	$ 5.35	$ 6.00	$ 6.00	$ 4.95	$ 4.95	$ 6.00
Cubic Yards Removed	225,000	362,000	225,000	362,000	293,000	362,000	293,500	293,500
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Variable Dredging Costs	$ 1,226,250	$ 1,972,900	$ 1,203,750	$2,172,000	$ 1,758,000	$ 1,791,900	$ 1,452,825	$ 1,761,000
Fixed Dredging Costs								
Mobilization & Demobilization	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000
E&D And S&A	$ 172,625	$ 247,290	$ 170,375	$ 267,200	$ 225,800	$ 229,190	$ 195,283	$ 226,100
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Fixed Dredging Costs	$ 472,625	$ 547,290	$ 470,375	$ 567,200	$ 525,800	$ 529,190	$ 495,283	$ 526,100
Total Dredging Costs Per Dredging Event	$ 1,698,875	$ 2,520,190	$ 1,674,125	$2,739,200	$ 2,283,800	$ 2,321,090	$ 1,948,108	$ 2,287,100
	Site 3	Site 3	Site 3a Cell 1	Site 3a Cell 1	Site 3a Cell 2	E 55th St Site 9 Cell 1	E 55th St Site 9 Cell 1	E 55th St Site 9 Cell 2 & 3
Cubic Yards Removed	362,000	293,000	362,000	293,500	293,500	362,000	293,500	293,500
Variable Dredging Costs								
Variable Cost Per Cubic Yard	$ 6.00	$ 6.00	$ 5.05	$ 5.05	$ 6.00	$ 5.65	$ 5.65	$ 5.55
Cubic Yards Removed	362,000	293,000	362,000	293,500	293,500	362,000	293,500	293,500
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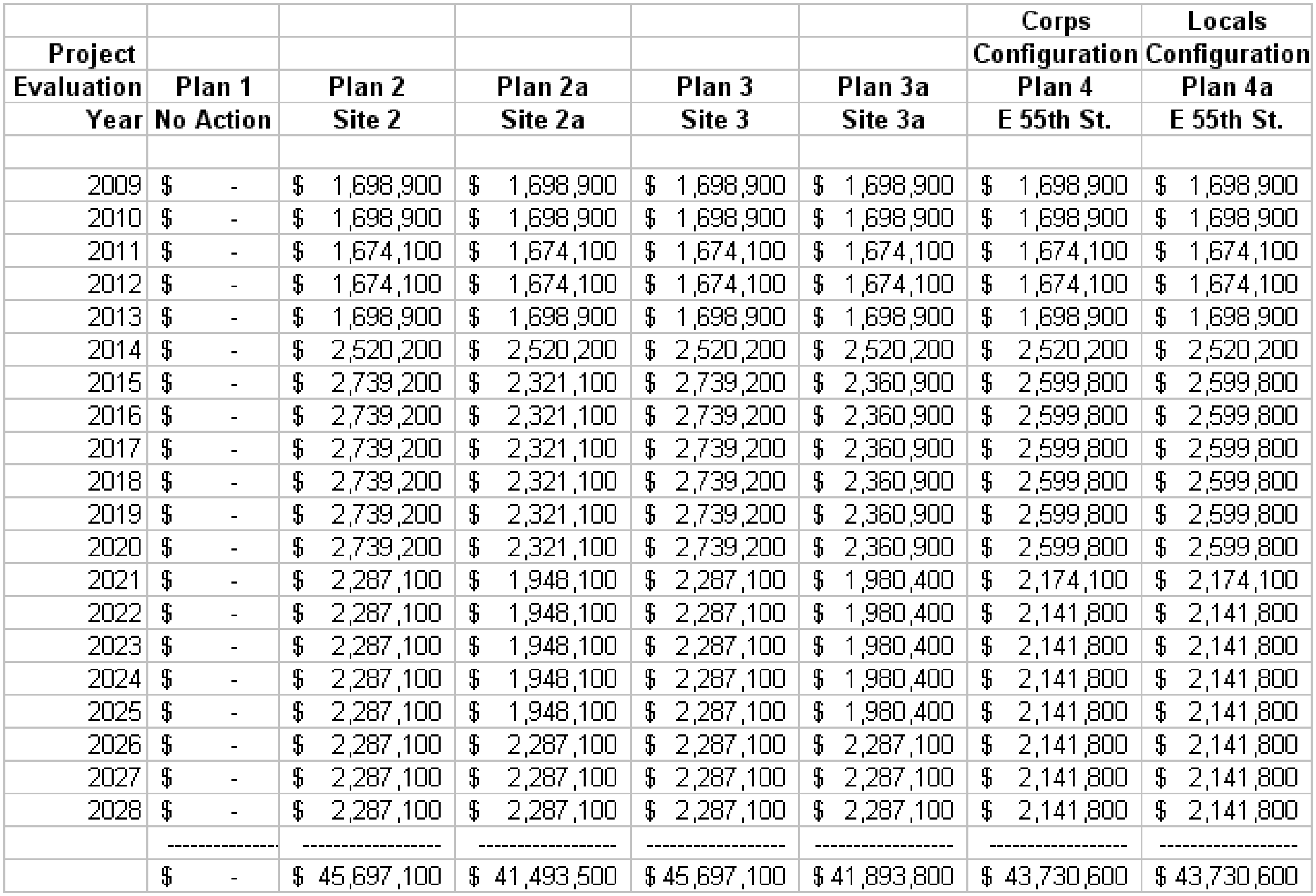
Variable Dredging Costs	$ 2,172,000	$ 1,758,000	$ 1,828,100	$1,482,175	$ 1,761,000	$ 2,045,300	$ 1,658,275	$ 1,628,925
Fixed Dredging Costs								
Mobilization & Demobilization	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000
E&D And S&A	$ 267,200	$ 225,800	$ 232,810	$ 198,218	$ 226,100	$ 254,530	$ 215,828	$ 212,893
	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------
Fixed Dredging Costs	$ 567,200	$ 525,800	$ 532,810	$ 498,218	$ 526,100	$ 554,530	$ 515,828	$ 512,893
Total Dredging Costs Per Dredging Event	$ 2,739,200	$ 2,283,800	$ 2,360,910	$1,980,393	$ 2,287,100	$ 2,599,830	$ 2,174,103	$ 2,141,818

Table 10 Timestream of Dredging Costs Per Year By Plan



Project Evaluation Year	Plan 1 No Action	Plan 2 Site 2	Plan 2a Site 2a	Plan 3 Site 3	Plan 3a Site 3a	Corps Configuration Plan 4 E 55th St.	Locals Configuration Plan 4a E 55th St.
2009	$ -	$ 1,698,900	$ 1,698,900	$ 1,698,900	$ 1,698,900	$ 1,698,900	$ 1,698,900
2010	$ -	$ 1,698,900	$ 1,698,900	$ 1,698,900	$ 1,698,900	$ 1,698,900	$ 1,698,900
2011	$ -	$ 1,674,100	$ 1,674,100	$ 1,674,100	$ 1,674,100	$ 1,674,100	$ 1,674,100
2012	$ -	$ 1,674,100	$ 1,674,100	$ 1,674,100	$ 1,674,100	$ 1,674,100	$ 1,674,100
2013	$ -	$ 1,698,900	$ 1,698,900	$ 1,698,900	$ 1,698,900	$ 1,698,900	$ 1,698,900
2014	$ -	$ 2,520,200	$ 2,520,200	$ 2,520,200	$ 2,520,200	$ 2,520,200	$ 2,520,200
2015	$ -	$ 2,739,200	$ 2,321,100	$ 2,739,200	$ 2,360,900	$ 2,599,800	$ 2,599,800
2016	$ -	$ 2,739,200	$ 2,321,100	$ 2,739,200	$ 2,360,900	$ 2,599,800	$ 2,599,800
2017	$ -	$ 2,739,200	$ 2,321,100	$ 2,739,200	$ 2,360,900	$ 2,599,800	$ 2,599,800
2018	$ -	$ 2,739,200	$ 2,321,100	$ 2,739,200	$ 2,360,900	$ 2,599,800	$ 2,599,800
2019	$ -	$ 2,739,200	$ 2,321,100	$ 2,739,200	$ 2,360,900	$ 2,599,800	$ 2,599,800
2020	$ -	$ 2,739,200	$ 2,321,100	$ 2,739,200	$ 2,360,900	$ 2,599,800	$ 2,599,800
2021	$ -	$ 2,287,100	$ 1,948,100	$ 2,287,100	$ 1,980,400	$ 2,174,100	$ 2,174,100
2022	$ -	$ 2,287,100	$ 1,948,100	$ 2,287,100	$ 1,980,400	$ 2,141,800	$ 2,141,800
2023	$ -	$ 2,287,100	$ 1,948,100	$ 2,287,100	$ 1,980,400	$ 2,141,800	$ 2,141,800
2024	$ -	$ 2,287,100	$ 1,948,100	$ 2,287,100	$ 1,980,400	$ 2,141,800	$ 2,141,800
2025	$ -	$ 2,287,100	$ 1,948,100	$ 2,287,100	$ 1,980,400	$ 2,141,800	$ 2,141,800
2026	$ -	$ 2,287,100	$ 2,287,100	$ 2,287,100	$ 2,287,100	$ 2,141,800	$ 2,141,800
2027	$ -	$ 2,287,100	$ 2,287,100	$ 2,287,100	$ 2,287,100	$ 2,141,800	$ 2,141,800
2028	$ -	$ 2,287,100	$ 2,287,100	$ 2,287,100	$ 2,287,100	$ 2,141,800	$ 2,141,800
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	$ -	$ 45,697,100	$ 41,493,500	$ 45,697,100	$ 41,893,800	$ 43,730,600	$ 43,730,600

This time stream of dredging costs was used as inputs to calculating average annual implementation costs associated with the plans evaluated. Dredging costs are just one of many components that make up implementation costs associated with each alternative.

IV. DEVELOPMENT OF PLAN AVERAGE ANNUAL COSTS

Section III described the alternative plans that would be evaluated in detail, and identified the year when various major expenditures would take place over the 20 year planning evaluation period. These major expenditures included dredging costs, implementing the FMP, new disposal site implementation costs (real estate, land costs, CDF engineering and design, plans and specs, construction costs, etc.) and fish habitat development. Other project construction/report related costs were identified (USFWS and NEPA report costs). "Other Recurring Costs" were also identified as well as the frequency of their occurrence. "Other Recurring Costs" include such items as sediment consolidation practices, harbor facility condition inspections/facility surveys, channel soundings, sediment sampling, periodic performance of baseline environmental, economic, and real estate studies, and active solicitation of sediment recycling and beneficial use projects.

Plan costs were developed for each year of the 20 year project evaluation period for each plan under With Project Conditions. These expenditure time streams are provided in Table 11 for each of the alternative plans evaluated.

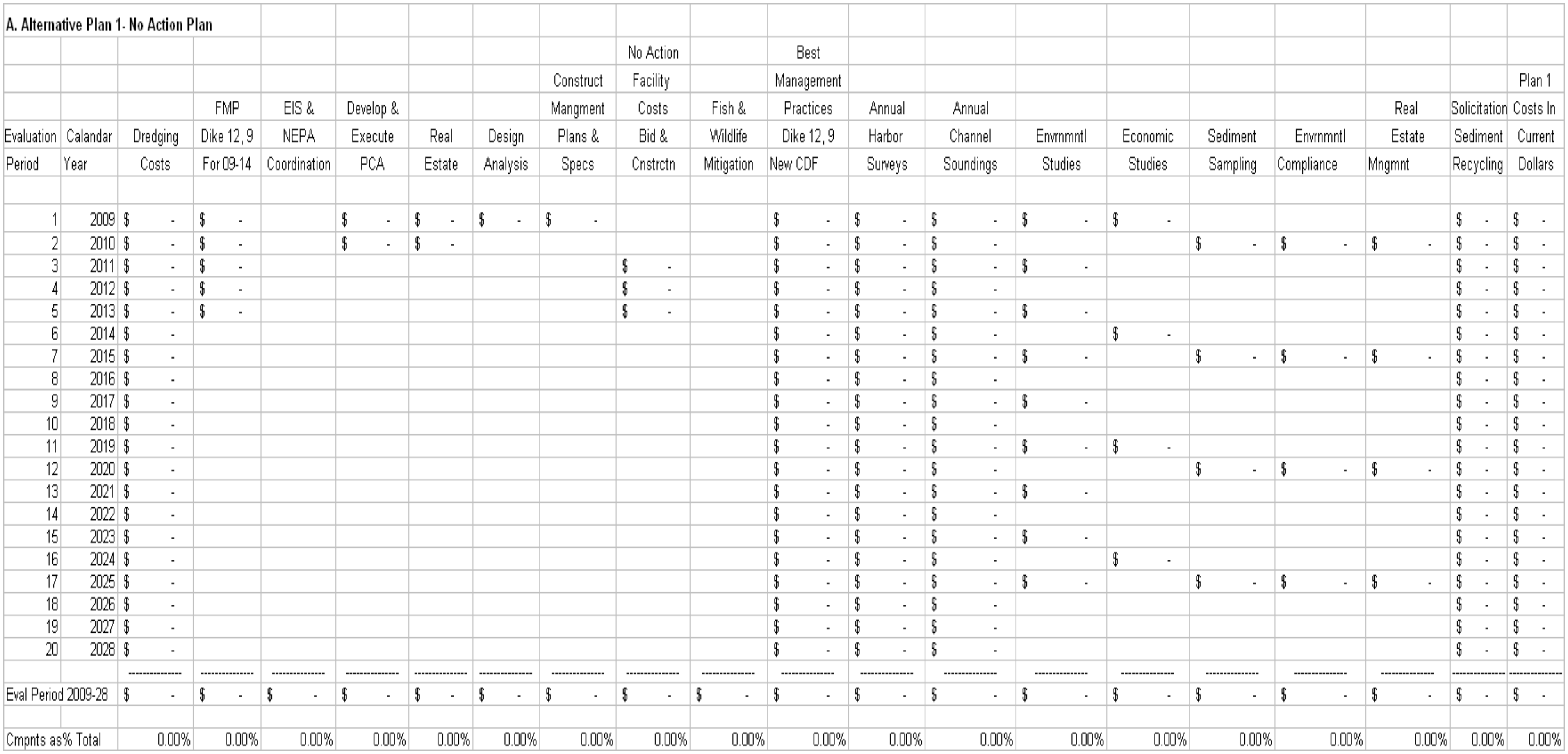
These time streams of costs were then brought back to their present worth values using the Federal discount rate of 4.625 percent. The plan evaluation period for this analysis is 20 years, starting in 2009 and ending in 2028. Table 12 provides a summary of this procedure. These present worth values in Table 12, for the various plans, represent an estimate of project first costs. Project first costs include Engineering and Design, Supervision and Administration, land costs by plan (since the land is acquired under Navigational Servitude, there is no land acquisition costs associated with Plans 2, 2a, 3 or 3a. Nominal real estate costs are associated with Plans 4 and 4a, which involve 1-2 acres of land needed for raw material staging needs) and fish habitat development costs. Interest during construction was added to first costs to arrive at investment costs. (Since benefits accrue immediately, there are no interest during construction costs). Total investment costs were converted to an average annual basis using the water resources Federal discount rate of 4.625 percent, and a 20 year project life. Annual maintenance costs were calculated as a percentage of contractors earnings and contingencies. Annual maintenance costs were added to average annualized investment costs to arrive at plan average annual costs. Table 13 provides average annual costs by alternative plan.

V IDENTIFCATION OF THE BASE PLAN

The process of identifying the Base Plan consists of developing a range of potential possible implementable plans, developing costs associated with these plans, and then identifying the plan that has the lowest cost. The Base Plan is defined as the least cost, environmentally acceptable disposal plan consistent with sound engineering practice.

Table 11 - Time Stream of Plan Costs

Alternative Plan 1- No Action



A. Alternative Plan 1- No Action Plan

Evaluation Period	Calandar Year	Dredging Costs	FMP Dike 12, 9 For 09-14	EIS & NEPA Coordination	Develop & Execute PCA	Real Estate	Design Analysis	Construct Mangment Plans & Specs	No Action Facility Costs Bid & Cnstrctn	Fish & Wildlife Mitigation	Best Management Practices Dike 12, 9 New CDF	Annual Harbor Surveys	Annual Channel Soundings	Envrnmntl Studies	Economic Studies	Sediment Sampling	Envrnmntl Compliance	Real Estate Mngmnt	Solicitation Sediment Recycling	Plan 1 Costs In Current Dollars
1	2009	$ -	$ -		$ -	$ -	$ -	$ -			$ -	$ -	$ -	$ -	$ -				$ -	$ -
2	2010	$ -	$ -		$ -	$ -					$ -	$ -	$ -			$ -	$ -	$ -	$ -	$ -
3	2011	$ -	$ -						$ -		$ -	$ -	$ -	$ -					$ -	$ -
4	2012	$ -	$ -						$ -		$ -	$ -	$ -						$ -	$ -
5	2013	$ -	$ -						$ -		$ -	$ -	$ -	$ -					$ -	$ -
6	2014	$ -									$ -	$ -	$ -		$ -				$ -	$ -
7	2015	$ -									$ -	$ -	$ -	$ -		$ -	$ -	$ -	$ -	$ -
8	2016	$ -									$ -	$ -	$ -						$ -	$ -
9	2017	$ -									$ -	$ -	$ -	$ -					$ -	$ -
10	2018	$ -									$ -	$ -	$ -						$ -	$ -
11	2019	$ -									$ -	$ -	$ -	$ -	$ -				$ -	$ -
12	2020	$ -									$ -	$ -	$ -			$ -	$ -	$ -	$ -	$ -
13	2021	$ -									$ -	$ -	$ -	$ -					$ -	$ -
14	2022	$ -									$ -	$ -	$ -						$ -	$ -
15	2023	$ -									$ -	$ -	$ -	$ -					$ -	$ -
16	2024	$ -									$ -	$ -	$ -		$ -				$ -	$ -
17	2025	$ -									$ -	$ -	$ -	$ -		$ -	$ -	$ -	$ -	$ -
18	2026	$ -									$ -	$ -	$ -						$ -	$ -
19	2027	$ -									$ -	$ -	$ -						$ -	$ -
20	2028	$ -									$ -	$ -	$ -						$ -	$ -
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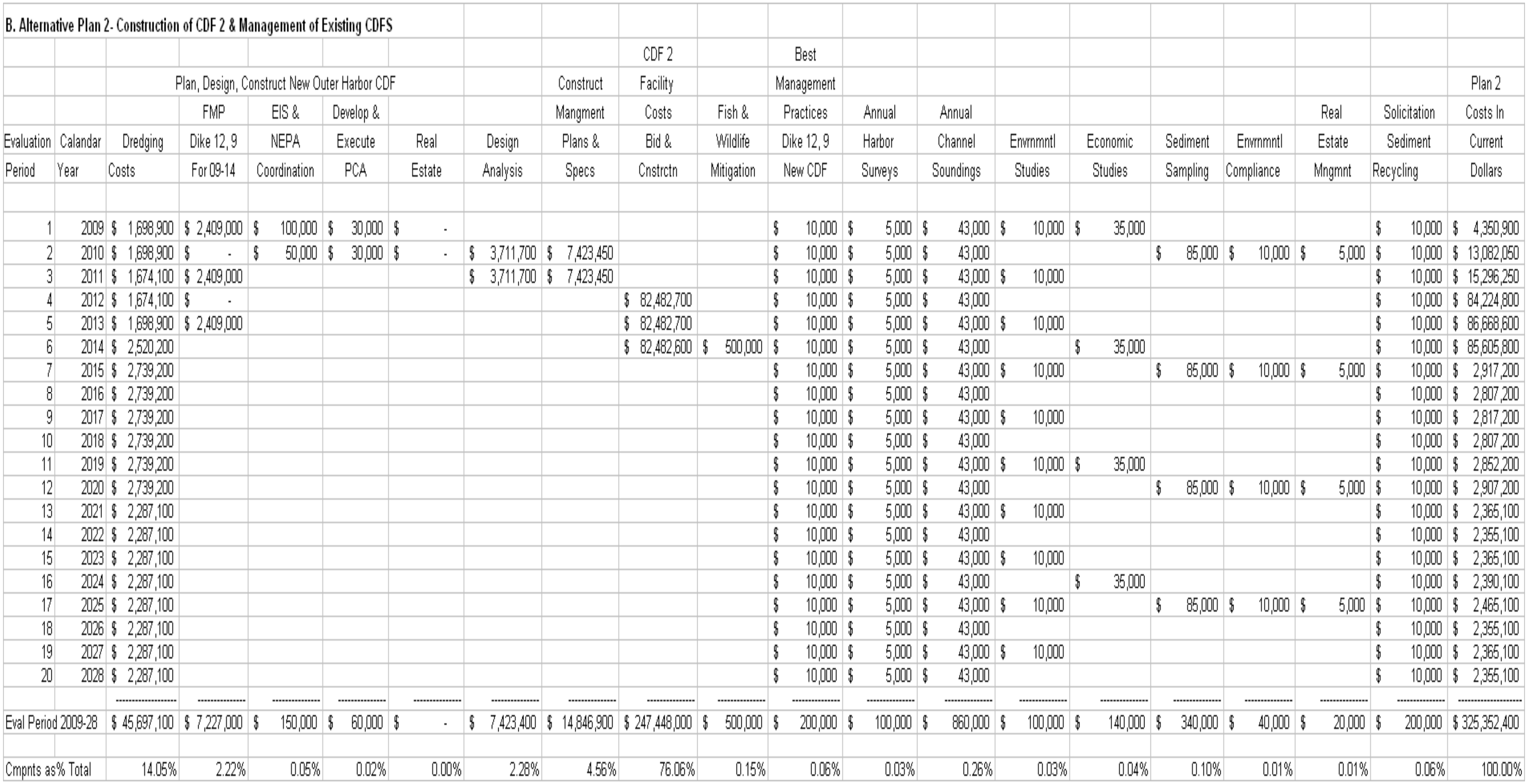
Eval Period 2009-28		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cmpnts as% Total		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Table 11 - Time Stream of Plan Costs-Continued

Alternative Plan 2- Fill Management Plan, New CDF at Site 2



B. Alternative Plan 2- Construction of CDF 2 & Management of Existing CDFS																				
									CDF 2		Best									
		Plan, Design, Construct New Outer Harbor CDF						Construct	Facility		Management									Plan 2
			FMP	EIS &	Develop &			Mangment	Costs	Fish &	Practices	Annual	Annual					Real	Solicitation	Costs In
Evaluation	Calandar	Dredging	Dike 12, 9	NEPA	Execute	Real	Design	Plans &	Bid &	Wildlife	Dike 12, 9	Harbor	Channel	Envrnmntl	Economic	Sediment	Envrnmntl	Estate	Sediment	Current
Period	Year	Costs	For 09-14	Coordination	PCA	Estate	Analysis	Specs	Cnstrctn	Mitigation	New CDF	Surveys	Soundings	Studies	Studies	Sampling	Compliance	Mngmnt	Recycling	Dollars
1	2009	$ 1,698,900	$ 2,409,000	$ 100,000	$ 30,000	$ -					$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 4,350,900
2	2010	$ 1,698,900	$ -	$ 50,000	$ 30,000	$ -	$ 3,711,700	$ 7,423,450			$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 13,082,050
3	2011	$ 1,674,100	$ 2,409,000				$ 3,711,700	$ 7,423,450			$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 15,296,250
4	2012	$ 1,674,100	$ -						$ 82,482,700		$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 84,224,800
5	2013	$ 1,698,900	$ 2,409,000						$ 82,482,700		$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 86,668,600
6	2014	$ 2,520,200							$ 82,482,600	$ 500,000	$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 85,605,800
7	2015	$ 2,739,200									$ 10,000	$ 5,000	$ 43,000	$ 10,000		$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,917,200
8	2016	$ 2,739,200									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,807,200
9	2017	$ 2,739,200									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,817,200
10	2018	$ 2,739,200									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,807,200
11	2019	$ 2,739,200									$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 2,852,200
12	2020	$ 2,739,200									$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,907,200
13	2021	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,365,100
14	2022	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,355,100
15	2023	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,365,100
16	2024	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 2,390,100
17	2025	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000	$ 10,000		$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,465,100
18	2026	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,355,100
19	2027	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,365,100
20	2028	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,355,100
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Eval Period 2009-28		$ 45,697,100	$ 7,227,000	$ 150,000	$ 60,000	$ -	$ 7,423,400	$ 14,846,900	$ 247,448,000	$ 500,000	$ 200,000	$ 100,000	$ 860,000	$ 100,000	$ 140,000	$ 340,000	$ 40,000	$ 20,000	$ 200,000	$ 325,352,400
Cmpnts as% Total		14.05%	2.22%	0.05%	0.02%	0.00%	2.28%	4.56%	76.06%	0.15%	0.06%	0.03%	0.26%	0.03%	0.04%	0.10%	0.01%	0.01%	0.06%	100.00%

Table 11 - Time Stream of Plan Costs-Continued

Alternative Plan 2a- Fill Management Plan, New CDF At Site 2a

B. Alternative Plan 2a- Construction of CDF 2a & Management of Existing CDFS																				
		Plan, Design, Construct New Outer Harbor CDF																		
Evaluation Period	Calandar Year	Dredging Costs	FMP Dike 12, 9 For 09-14	EIS & NEPA Coordination	Develop & Execute PCA	Real Estate	Design Analysis	Construct Mangment Plans & Specs	CDF 2a Facility Costs Bid & Cnstrctn	Fish & Wildlife Mitigation	Best Management Practices Dike 12, 9 New CDF	Annual Harbor Surveys	Annual Channel Soundings	Envrnmntl Studies	Economic Studies	Sediment Sampling	Envrnmntl Compliance	Real Estate Mngmnt	Solicitation Sediment Recycling	Plan 2a Costs In Current Dollars
1	2009	$ 1,698,900	$ 2,409,000	$ 100,000	$ 30,000	$ -					$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 4,350,900
2	2010	$ 1,698,900	$ -	$ 50,000	$ 30,000	$ -	$ 1,798,700	$ 3,597,400			$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 7,343,000
3	2011	$ 1,674,100	$ 2,409,000				$ 1,798,700	$ 3,597,400			$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 9,557,200
4	2012	$ 1,674,100	$ -						$ 39,971,000		$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 41,713,100
5	2013	$ 1,698,900	$ 2,409,000						$ 39,971,000		$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 44,156,900
6	2014	$ 2,520,200							$ 39,971,000	$ 250,000	$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 42,844,200
7	2015	$ 2,321,100									$ 10,000	$ 5,000	$ 43,000	$ 10,000		$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,499,100
8	2016	$ 2,321,100									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,389,100
9	2017	$ 2,321,100				$ -					$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,399,100
10	2018	$ 2,321,100				$ -	$ 2,187,000	$ 4,374,000			$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 8,950,100
11	2019	$ 2,321,100					$ 2,187,000	$ 4,374,000			$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 8,995,100
12	2020	$ 2,321,100							$ 48,599,700		$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 51,088,800
13	2021	$ 1,948,100							$ 48,599,700		$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 50,625,800
14	2022	$ 1,948,100							$ 48,599,600	$ 250,000	$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 50,865,700
15	2023	$ 1,948,100									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,026,100
16	2024	$ 1,948,100									$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 2,051,100
17	2025	$ 1,948,100									$ 10,000	$ 5,000	$ 43,000	$ 10,000		$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,126,100
18	2026	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,355,100
19	2027	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,365,100
20	2028	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,355,100
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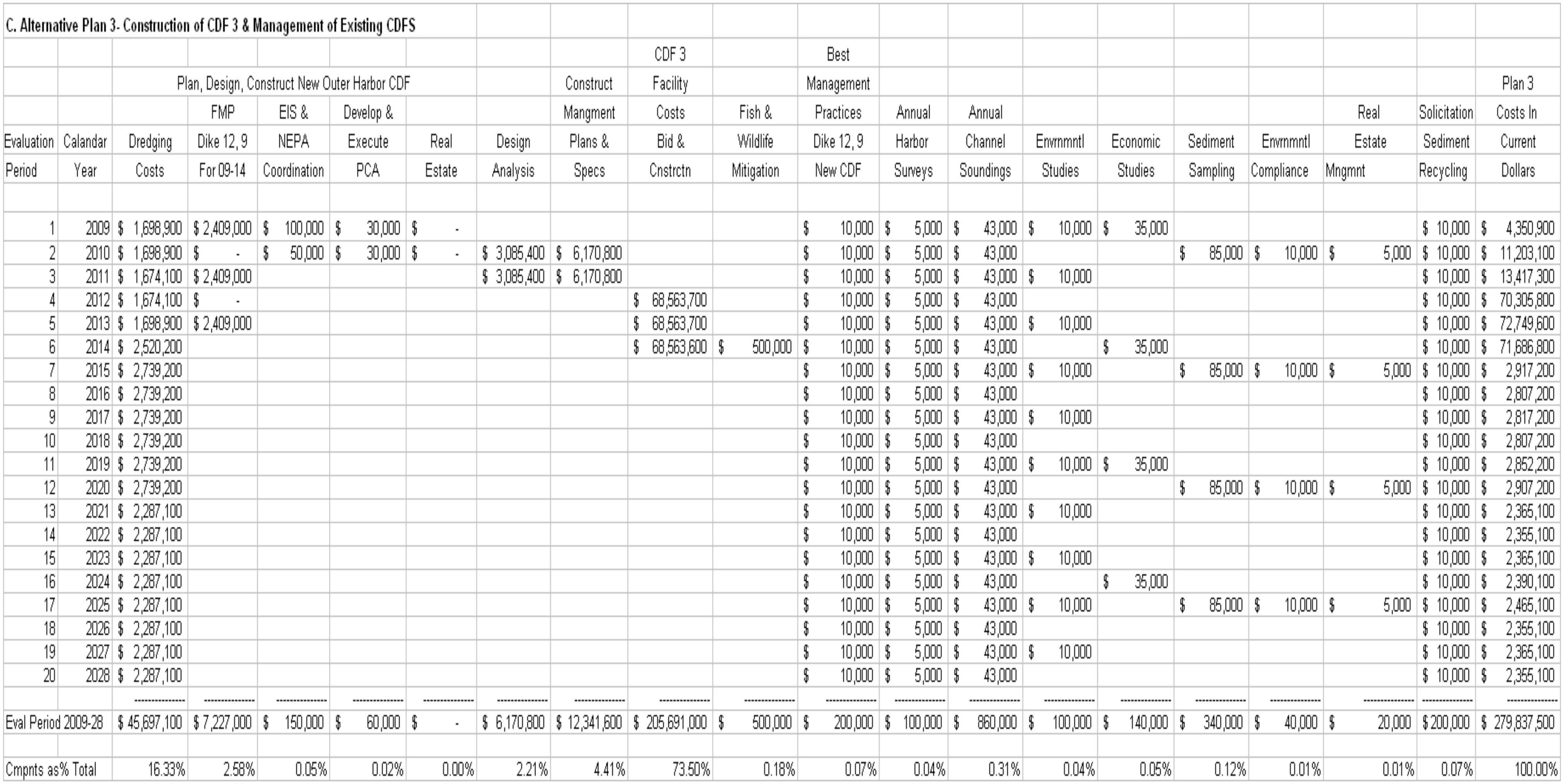
Eval Period 2009-28		$ 41,493,500	$ 7,227,000	$ 150,000	$ 60,000	$ -	$ 7,971,400	$ 15,942,800	$ 265,712,000	$ 500,000	$ 200,000	$ 100,000	$ 860,000	$ 100,000	$ 140,000	$ 340,000	$ 40,000	$ 20,000	$ 200,000	$ 341,056,700
Cmpnts as% Total		12.17%	2.12%	0.04%	0.02%	0.00%	2.34%	4.67%	77.91%	0.15%	0.06%	0.03%	0.25%	0.03%	0.04%	0.10%	0.01%	0.01%	0.06%	100.00%

Table 11 - Time Stream of Plan Costs-Continued

Alternative Plan 3- Fill Management Plan, New CDF At Site 3



C. Alternative Plan 3- Construction of CDF 3 & Management of Existing CDFS																				
		Plan, Design, Construct New Outer Harbor CDF																		
Evaluation Period	Calandar Year	Dredging Costs	FMP Dike 12, 9 For 09-14	EIS & NEPA Coordination	Develop & Execute PCA	Real Estate	Design Analysis	Construct Mangment Plans & Specs	CDF 3 Facility Costs Bid & Cnstrctn	Fish & Wildlife Mitigation	Best Management Practices Dike 12, 9 New CDF	Annual Harbor Surveys	Annual Channel Soundings	Envrnmntl Studies	Economic Studies	Sediment Sampling	Envrnmntl Compliance	Real Estate Mngmnt	Solicitation Sediment Recycling	Plan 3 Costs In Current Dollars
1	2009	$ 1,698,900	$ 2,409,000	$ 100,000	$ 30,000	$ -					$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 4,350,900
2	2010	$ 1,698,900	$ -	$ 50,000	$ 30,000	$ -	$ 3,085,400	$ 6,170,800			$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 11,203,100
3	2011	$ 1,674,100	$ 2,409,000				$ 3,085,400	$ 6,170,800			$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 13,417,300
4	2012	$ 1,674,100	$ -						$ 68,563,700		$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 70,305,800
5	2013	$ 1,698,900	$ 2,409,000						$ 68,563,700		$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 72,749,600
6	2014	$ 2,520,200							$ 68,563,600	$ 500,000	$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 71,686,800
7	2015	$ 2,739,200									$ 10,000	$ 5,000	$ 43,000	$ 10,000		$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,917,200
8	2016	$ 2,739,200									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,807,200
9	2017	$ 2,739,200									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,817,200
10	2018	$ 2,739,200									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,807,200
11	2019	$ 2,739,200									$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 2,852,200
12	2020	$ 2,739,200									$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,907,200
13	2021	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,365,100
14	2022	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,355,100
15	2023	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,365,100
16	2024	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 2,390,100
17	2025	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000	$ 10,000		$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,465,100
18	2026	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,355,100
19	2027	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,365,100
20	2028	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,355,100
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Eval Period 2009-28		$ 45,697,100	$ 7,227,000	$ 150,000	$ 60,000	$ -	$ 6,170,800	$ 12,341,600	$ 205,691,000	$ 500,000	$ 200,000	$ 100,000	$ 860,000	$ 100,000	$ 140,000	$ 340,000	$ 40,000	$ 20,000	$ 200,000	$ 279,837,500
Cmpnts as% Total		16.33%	2.58%	0.05%	0.02%	0.00%	2.21%	4.41%	73.50%	0.18%	0.07%	0.04%	0.31%	0.04%	0.05%	0.12%	0.01%	0.01%	0.07%	100.00%

Table 11 - Time Stream of Plan Costs-Continued

Alternative Plan 3a- Fill Management Plan, New CDF At Site 3a

C. Alternative Plan 3a- Construction of CDF 3a & Management of Existing CDFS																				
		Plan, Design, Construct New Outer Harbor CDF																		
Evaluation Period	Calandar Year	Dredging Costs	FMP Dike 12, 9 For 09-14	EIS & NEPA Coordination	Develop & Execute PCA	Real Estate	Design Analysis	Construct Mangment Plans & Specs	CDF 3a Facility Costs Bid & Cnstrctn	Fish & Wildlife Mitigation	Best Management Practices Dike 12, 9 New CDF	Annual Harbor Surveys	Annual Channel Soundings	Envrnmntl Studies	Economic Studies	Sediment Sampling	Envrnmntl Compliance	Real Estate Mngmnt	Solicitation Sediment Recycling	Plan 3a Costs In Current Dollars
1	2009	$ 1,698,900	$ 2,409,000	$ 100,000	$ 30,000	$ -					$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 4,350,900
2	2010	$ 1,698,900	$ -	$ 50,000	$ 30,000	$ -	$ 2,081,850	$ 4,163,650			$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 8,192,400
3	2011	$ 1,674,100	$ 2,409,000				$ 2,081,850	$ 4,163,650			$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 10,406,600
4	2012	$ 1,674,100	$ -						$ 46,263,000		$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 48,005,100
5	2013	$ 1,698,900	$ 2,409,000						$ 46,263,000		$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 50,448,900
6	2014	$ 2,520,200				$ -			$ 46,263,000	$ 250,000	$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 49,136,200
7	2015	$ 2,360,900				$ -	$ 3,023,300	$ 6,046,500			$ 10,000	$ 5,000	$ 43,000	$ 10,000		$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 11,608,700
8	2016	$ 2,360,900					$ 3,023,300	$ 6,046,500			$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 11,498,700
9	2017	$ 2,360,900							$ 67,183,300		$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 69,622,200
10	2018	$ 2,360,900							$ 67,183,300		$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 69,612,200
11	2019	$ 2,360,900							$ 67,183,400	$ 250,000	$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 69,907,300
12	2020	$ 2,360,900									$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,528,900
13	2021	$ 1,980,400									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,058,400
14	2022	$ 1,980,400									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,048,400
15	2023	$ 1,980,400									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,058,400
16	2024	$ 1,980,400									$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 2,083,400
17	2025	$ 1,980,400									$ 10,000	$ 5,000	$ 43,000	$ 10,000		$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,158,400
18	2026	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,355,100
19	2027	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,365,100
20	2028	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,355,100
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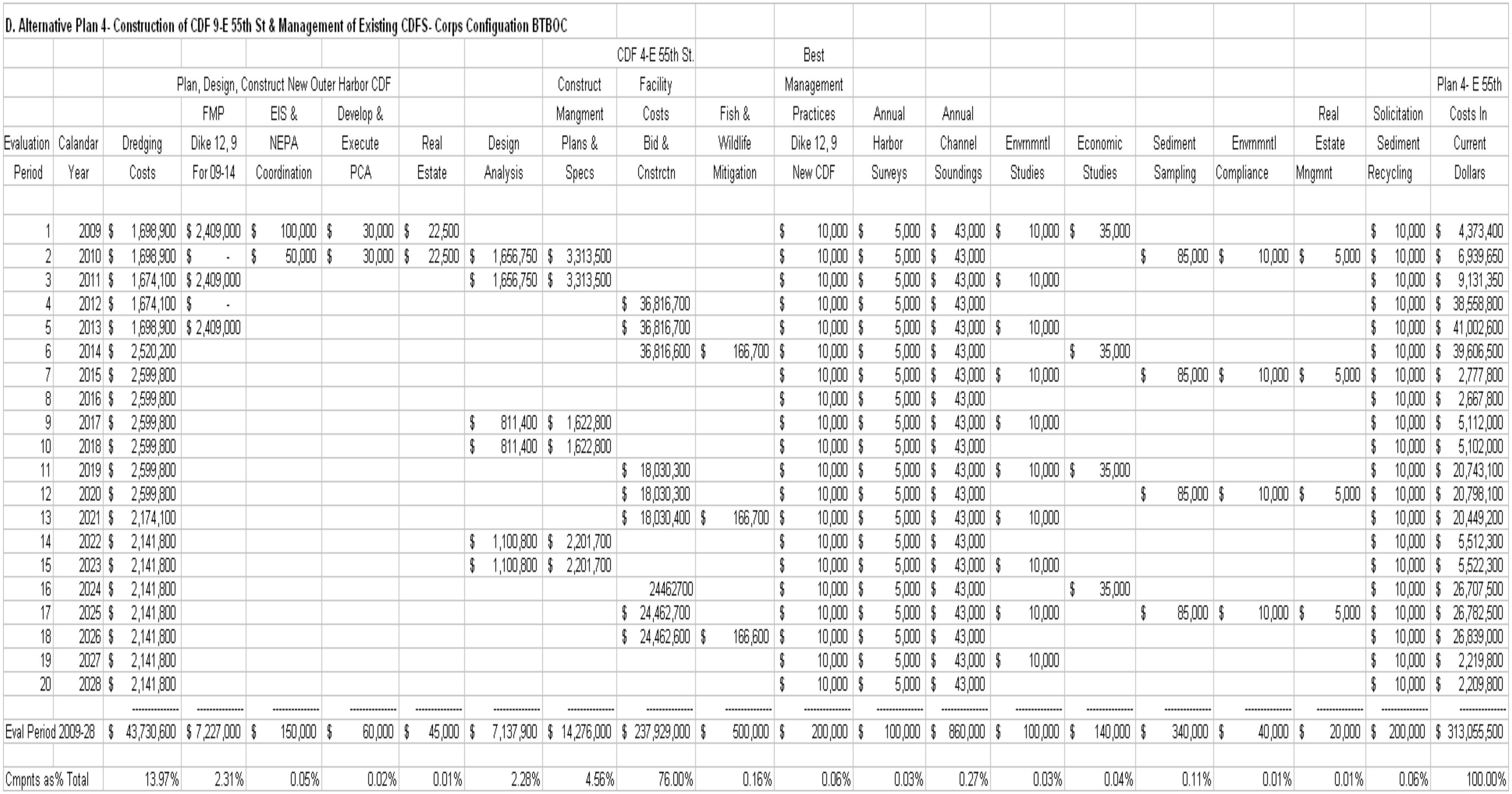
Eval Period 2009-28		$ 41,893,800	$ 7,227,000	$ 150,000	$ 60,000	$ -	$ 10,210,300	$ 20,420,300	$ 340,339,000	$ 500,000	$ 200,000	$ 100,000	$ 860,000	$ 100,000	$ 140,000	$ 340,000	$ 40,000	$ 20,000	$ 200,000	$ 422,800,400
Cmpnts as% Total		9.91%	1.71%	0.04%	0.01%	0.00%	2.41%	4.83%	80.50%	0.12%	0.05%	0.02%	0.20%	0.02%	0.03%	0.08%	0.01%	0.00%	0.05%	100.00%

Table 11 - Time Stream of Plan Costs-Continued

Alternative Plan 4 Fill Management Plan, New CDF At Site 9-E 55th St. –Corps Configuration



D. Alternative Plan 4- Construction of CDF 9-E 55th St & Management of Existing CDFS- Corps Configuation BTBOC																				
			Plan, Design, Construct New Outer Harbor CDF																	
Evaluation Period	Calandar Year	Dredging Costs	FMP Dike 12, 9 For 09-14	EIS & NEPA Coordination	Develop & Execute PCA	Real Estate	Design Analysis	Construct Mangment Plans & Specs	CDF 4-E 55th St. Facility Costs Bid & Cnstrctn	Fish & Wildlife Mitigation	Best Management Practices Dike 12, 9 New CDF	Annual Harbor Surveys	Annual Channel Soundings	Envrnmntl Studies	Economic Studies	Sediment Sampling	Envrnmntl Compliance	Real Estate Mngmnt	Solicitation Sediment Recycling	Plan 4- E 55th Costs In Current Dollars
1	2009	$ 1,698,900	$ 2,409,000	$ 100,000	$ 30,000	$ 22,500					$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 4,373,400
2	2010	$ 1,698,900	$ -	$ 50,000	$ 30,000	$ 22,500	$ 1,656,750	$ 3,313,500			$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 6,939,650
3	2011	$ 1,674,100	$ 2,409,000				$ 1,656,750	$ 3,313,500			$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 9,131,350
4	2012	$ 1,674,100	$ -						$ 36,816,700		$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 38,558,800
5	2013	$ 1,698,900	$ 2,409,000						$ 36,816,700		$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 41,002,600
6	2014	$ 2,520,200							36,816,600	$ 166,700	$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 39,606,500
7	2015	$ 2,599,800									$ 10,000	$ 5,000	$ 43,000	$ 10,000		$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,777,800
8	2016	$ 2,599,800									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,667,800
9	2017	$ 2,599,800					$ 811,400	$ 1,622,800			$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 5,112,000
10	2018	$ 2,599,800					$ 811,400	$ 1,622,800			$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 5,102,000
11	2019	$ 2,599,800							$ 18,030,300		$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 20,743,100
12	2020	$ 2,599,800							$ 18,030,300		$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 20,798,100
13	2021	$ 2,174,100							$ 18,030,400	$ 166,700	$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 20,449,200
14	2022	$ 2,141,800					$ 1,100,800	$ 2,201,700			$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 5,512,300
15	2023	$ 2,141,800					$ 1,100,800	$ 2,201,700			$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 5,522,300
16	2024	$ 2,141,800							24462700		$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 26,707,500
17	2025	$ 2,141,800							$ 24,462,700		$ 10,000	$ 5,000	$ 43,000	$ 10,000		$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 26,782,500
18	2026	$ 2,141,800							$ 24,462,600	$ 166,600	$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 26,839,000
19	2027	$ 2,141,800									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,219,800
20	2028	$ 2,141,800									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,209,800
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Eval Period 2009-28		$ 43,730,600	$ 7,227,000	$ 150,000	$ 60,000	$ 45,000	$ 7,137,900	$ 14,276,000	$ 237,929,000	$ 500,000	$ 200,000	$ 100,000	$ 860,000	$ 100,000	$ 140,000	$ 340,000	$ 40,000	$ 20,000	$ 200,000	$ 313,055,500
Cmpnts as% Total		13.97%	2.31%	0.05%	0.02%	0.01%	2.28%	4.56%	76.00%	0.16%	0.06%	0.03%	0.27%	0.03%	0.04%	0.11%	0.01%	0.01%	0.06%	100.00%

Table 11 - Time Stream of Plan Costs-Continued

Alternative Plan 4a Fill Management Plan, New CDF At Site 9-E 55th St. –Locals Configuration

D. Alternative Plan 4a- Construction of CDF at E 55th St & Management of Existing CDFS- Local Configuration																				
		Plan, Design, Construct New Outer Harbor CDF																		
Evaluation Period	Calandar Year	Dredging Costs	FMP Dike 12, 9 For 09-14	EIS & NEPA Coordination	Develop & Execute PCA	Real Estate	Design Analysis	Construct Mangment Plans & Specs	CDF 5-E 55th St. Facility Costs Bid & Cnstrctn	Fish & Wildlife Mitigation	Best Management Practices Dike 12, 9 New CDF	Annual Harbor Surveys	Annual Channel Soundings	Envrnmntl Studies	Economic Studies	Sediment Sampling	Envrnmntl Compliance	Real Estate Mngmnt	Solicitation Sediment Recycling	Plan 4a- E 55th Costs In Current Dollars
1	2009	$ 1,698,900	$ 2,409,000	$ 100,000	$ 30,000	$ 22,500					$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 4,373,400
2	2010	$ 1,698,900	$ -	$ 50,000	$ 30,000	$ 22,500	$ 1,945,000	$ 3,890,000			$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 7,804,400
3	2011	$ 1,674,100	$ 2,409,000				$ 1,945,000	$ 3,890,000			$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 9,996,100
4	2012	$ 1,674,100	$ -						$ 43,222,300		$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 44,964,400
5	2013	$ 1,698,900	$ 2,409,000						$ 43,222,300		$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 47,408,200
6	2014	$ 2,520,200							43,222,400	$ 166,700	$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 46,012,300
7	2015	$ 2,599,800									$ 10,000	$ 5,000	$ 43,000	$ 10,000		$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,777,800
8	2016	$ 2,599,800									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,667,800
9	2017	$ 2,599,800					$ 907,700	$ 1,815,400			$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 5,400,900
10	2018	$ 2,599,800					$ 907,700	$ 1,815,400			$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 5,390,900
11	2019	$ 2,599,800							$ 20,171,000		$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 22,883,800
12	2020	$ 2,599,800							$ 20,171,000		$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 22,938,800
13	2021	$ 2,174,100							$ 20,171,000	$ 166,700	$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 22,589,800
14	2022	$ 2,141,800					$ 1,302,100	$ 2,604,200			$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 6,116,100
15	2023	$ 2,141,800					$ 1,302,100	$ 2,604,200			$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 6,126,100
16	2024	$ 2,141,800							$ 28,935,700		$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 31,180,500
17	2025	$ 2,141,800							$ 28,935,700		$ 10,000	$ 5,000	$ 43,000	$ 10,000		$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 31,255,500
18	2026	$ 2,141,800							$ 28,935,600	$ 166,600	$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 31,312,000
19	2027	$ 2,141,800									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,219,800
20	2028	$ 2,141,800									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,209,800
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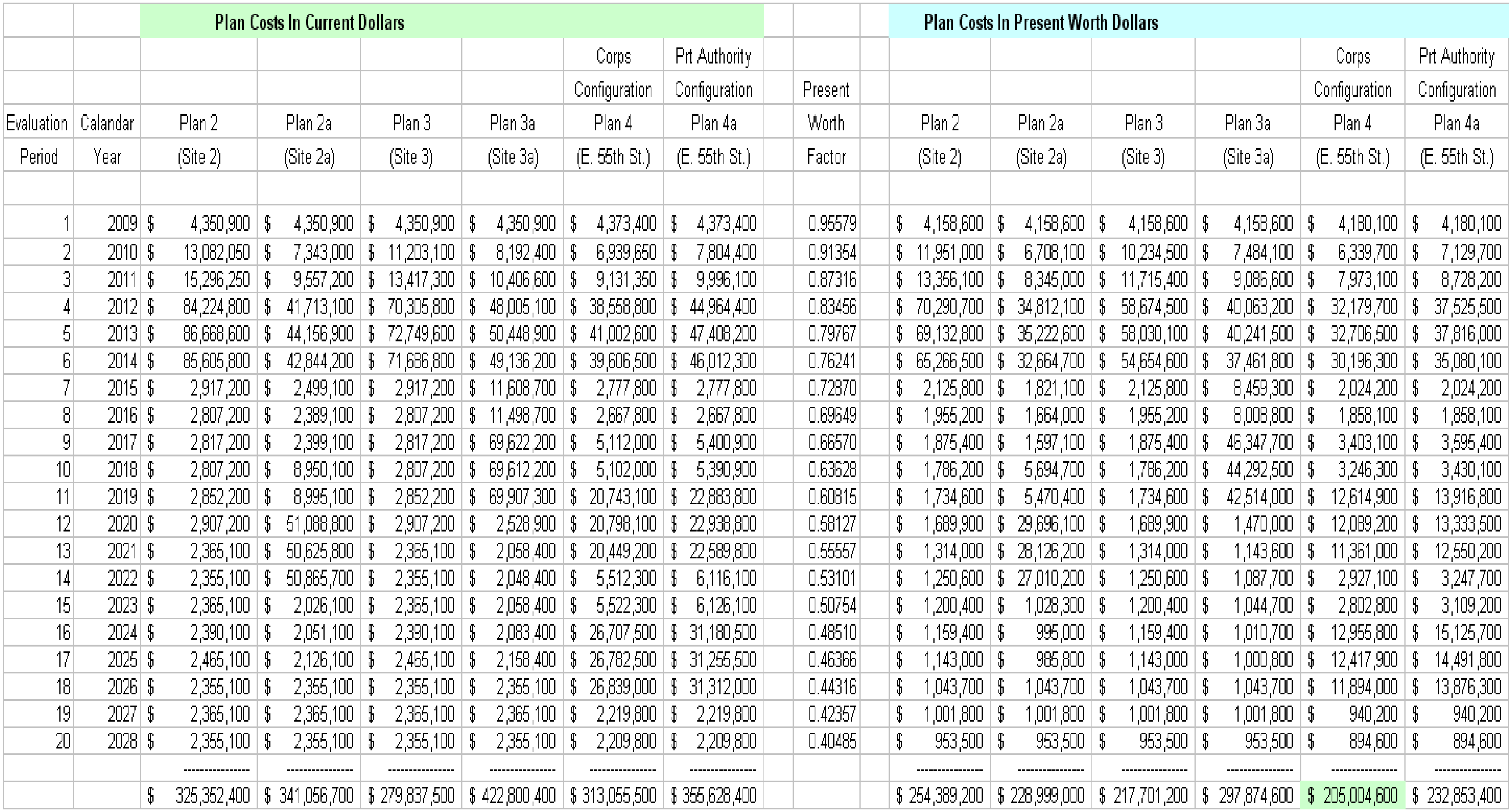
Eval Period 2009-28		$ 43,730,600	$ 7,227,000	$ 150,000	$ 60,000	$ 45,000	$ 8,309,600	$ 16,619,200	$ 276,987,000	$ 500,000	$ 200,000	$ 100,000	$ 860,000	$ 100,000	$ 140,000	$ 340,000	$ 40,000	$ 20,000	$ 200,000	$ 355,628,400
Cmpnts as% Total		12.30%	2.03%	0.04%	0.02%	0.01%	2.34%	4.67%	77.89%	0.14%	0.06%	0.03%	0.24%	0.03%	0.04%	0.10%	0.01%	0.01%	0.06%	100.00%

Table 12 Present Worth Of Plan Costs- Plan 1, 2, 2a, 3, 3a, 4, 4a



		Plan Costs In Current Dollars							Plan Costs In Present Worth Dollars					
Evaluation Period	Calandar Year	Plan 2 (Site 2)	Plan 2a (Site 2a)	Plan 3 (Site 3)	Plan 3a (Site 3a)	Corps Configuration Plan 4 (E. 55th St.)	Prt Authority Configuration Plan 4a (E. 55th St.)	Present Worth Factor	Plan 2 (Site 2)	Plan 2a (Site 2a)	Plan 3 (Site 3)	Plan 3a (Site 3a)	Corps Configuration Plan 4 (E. 55th St.)	Prt Authority Configuration Plan 4a (E. 55th St.)
1	2009	$ 4,350,900	$ 4,350,900	$ 4,350,900	$ 4,350,900	$ 4,373,400	$ 4,373,400	0.95579	$ 4,158,600	$ 4,158,600	$ 4,158,600	$ 4,158,600	$ 4,180,100	$ 4,180,100
2	2010	$ 13,082,050	$ 7,343,000	$ 11,203,100	$ 8,192,400	$ 6,939,650	$ 7,804,400	0.91354	$ 11,951,000	$ 6,708,100	$ 10,234,500	$ 7,484,100	$ 6,339,700	$ 7,129,700
3	2011	$ 15,296,250	$ 9,557,200	$ 13,417,300	$ 10,406,600	$ 9,131,350	$ 9,996,100	0.87316	$ 13,356,100	$ 8,345,000	$ 11,715,400	$ 9,086,600	$ 7,973,100	$ 8,728,200
4	2012	$ 84,224,800	$ 41,713,100	$ 70,305,800	$ 48,005,100	$ 38,558,800	$ 44,964,400	0.83456	$ 70,290,700	$ 34,812,100	$ 58,674,500	$ 40,063,200	$ 32,179,700	$ 37,525,500
5	2013	$ 86,668,600	$ 44,156,900	$ 72,749,600	$ 50,448,900	$ 41,002,600	$ 47,408,200	0.79767	$ 69,132,800	$ 35,222,600	$ 58,030,100	$ 40,241,500	$ 32,706,500	$ 37,816,000
6	2014	$ 85,605,800	$ 42,844,200	$ 71,686,800	$ 49,136,200	$ 39,606,500	$ 46,012,300	0.76241	$ 65,266,500	$ 32,664,700	$ 54,654,600	$ 37,461,800	$ 30,196,300	$ 35,080,100
7	2015	$ 2,917,200	$ 2,499,100	$ 2,917,200	$ 11,608,700	$ 2,777,800	$ 2,777,800	0.72870	$ 2,125,800	$ 1,821,100	$ 2,125,800	$ 8,459,300	$ 2,024,200	$ 2,024,200
8	2016	$ 2,807,200	$ 2,389,100	$ 2,807,200	$ 11,498,700	$ 2,667,800	$ 2,667,800	0.69649	$ 1,955,200	$ 1,664,000	$ 1,955,200	$ 8,008,800	$ 1,858,100	$ 1,858,100
9	2017	$ 2,817,200	$ 2,399,100	$ 2,817,200	$ 69,622,200	$ 5,112,000	$ 5,400,900	0.66570	$ 1,875,400	$ 1,597,100	$ 1,875,400	$ 46,347,700	$ 3,403,100	$ 3,595,400
10	2018	$ 2,807,200	$ 8,950,100	$ 2,807,200	$ 69,612,200	$ 5,102,000	$ 5,390,900	0.63628	$ 1,786,200	$ 5,694,700	$ 1,786,200	$ 44,292,500	$ 3,246,300	$ 3,430,100
11	2019	$ 2,852,200	$ 8,995,100	$ 2,852,200	$ 69,907,300	$ 20,743,100	$ 22,883,800	0.60815	$ 1,734,600	$ 5,470,400	$ 1,734,600	$ 42,514,000	$ 12,614,900	$ 13,916,800
12	2020	$ 2,907,200	$ 51,088,800	$ 2,907,200	$ 2,528,900	$ 20,798,100	$ 22,938,800	0.58127	$ 1,689,900	$ 29,696,100	$ 1,689,900	$ 1,470,000	$ 12,089,200	$ 13,333,500
13	2021	$ 2,365,100	$ 50,625,800	$ 2,365,100	$ 2,058,400	$ 20,449,200	$ 22,589,800	0.55557	$ 1,314,000	$ 28,126,200	$ 1,314,000	$ 1,143,600	$ 11,361,000	$ 12,550,200
14	2022	$ 2,355,100	$ 50,865,700	$ 2,355,100	$ 2,048,400	$ 5,512,300	$ 6,116,100	0.53101	$ 1,250,600	$ 27,010,200	$ 1,250,600	$ 1,087,700	$ 2,927,100	$ 3,247,700
15	2023	$ 2,365,100	$ 2,026,100	$ 2,365,100	$ 2,058,400	$ 5,522,300	$ 6,126,100	0.50754	$ 1,200,400	$ 1,028,300	$ 1,200,400	$ 1,044,700	$ 2,802,800	$ 3,109,200
16	2024	$ 2,390,100	$ 2,051,100	$ 2,390,100	$ 2,083,400	$ 26,707,500	$ 31,180,500	0.48510	$ 1,159,400	$ 995,000	$ 1,159,400	$ 1,010,700	$ 12,955,800	$ 15,125,700
17	2025	$ 2,465,100	$ 2,126,100	$ 2,465,100	$ 2,158,400	$ 26,782,500	$ 31,255,500	0.46366	$ 1,143,000	$ 985,800	$ 1,143,000	$ 1,000,800	$ 12,417,900	$ 14,491,800
18	2026	$ 2,355,100	$ 2,355,100	$ 2,355,100	$ 2,355,100	$ 26,839,000	$ 31,312,000	0.44316	$ 1,043,700	$ 1,043,700	$ 1,043,700	$ 1,043,700	$ 11,894,000	$ 13,876,300
19	2027	$ 2,365,100	$ 2,365,100	$ 2,365,100	$ 2,365,100	$ 2,219,800	$ 2,219,800	0.42357	$ 1,001,800	$ 1,001,800	$ 1,001,800	$ 1,001,800	$ 940,200	$ 940,200
20	2028	$ 2,355,100	$ 2,355,100	$ 2,355,100	$ 2,355,100	$ 2,209,800	$ 2,209,800	0.40485	$ 953,500	$ 953,500	$ 953,500	$ 953,500	$ 894,600	$ 894,600
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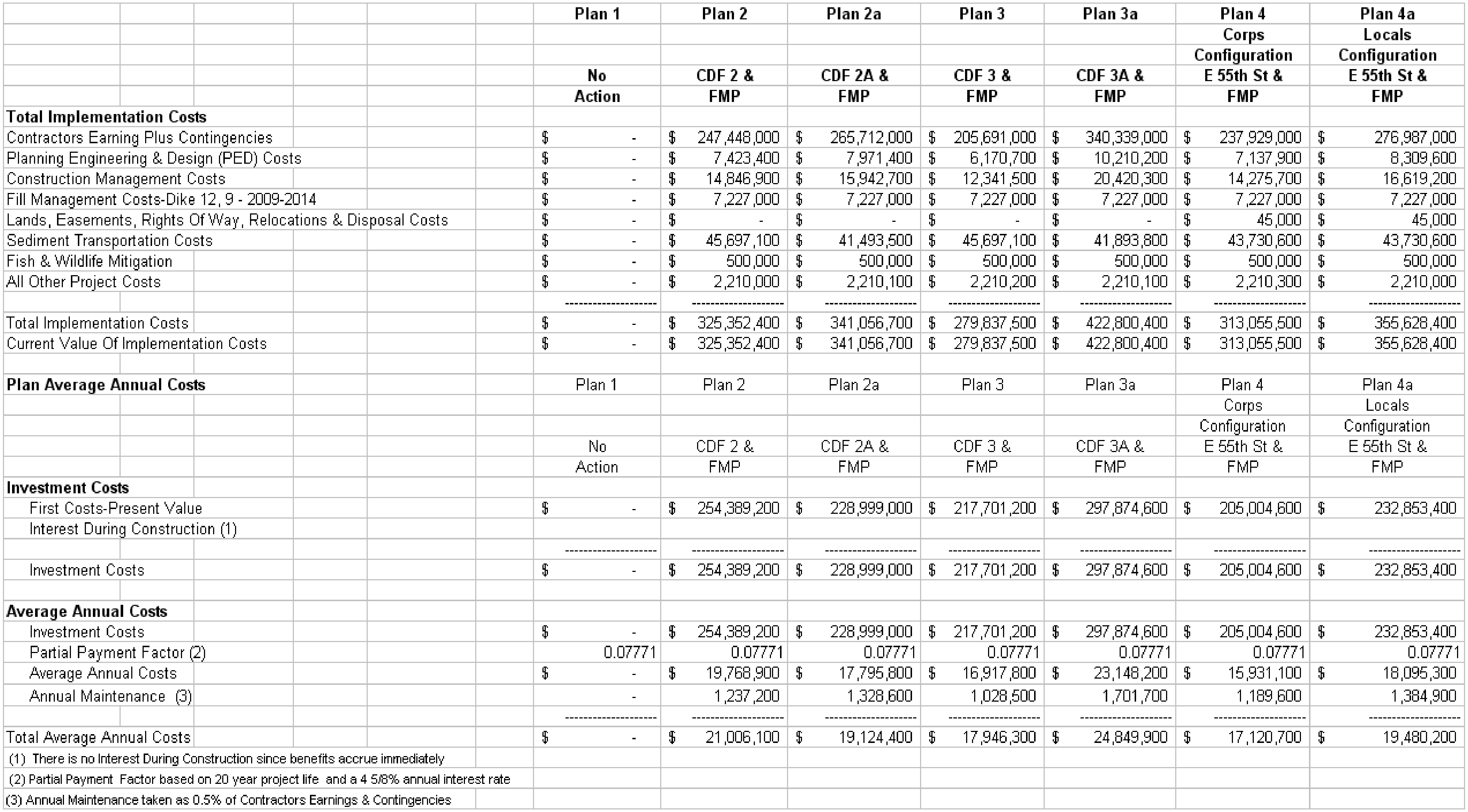
		$ 325,352,400	$ 341,056,700	$ 279,837,500	$ 422,800,400	$ 313,055,500	$ 355,628,400		$ 254,389,200	$ 228,999,000	$ 217,701,200	$ 297,874,600	$ 205,004,600	$ 232,853,400

Table 13- Plan Average Annual Costs



	Plan 1	Plan 2	Plan 2a	Plan 3	Plan 3a	Plan 4	Plan 4a
						Corps	Locals
						Configuration	Configuration
	No	CDF 2 &	CDF 2A &	CDF 3 &	CDF 3A &	E 55th St &	E 55th St &
	Action	FMP	FMP	FMP	FMP	FMP	FMP
Total Implementation Costs							
Contractors Earning Plus Contingencies	$ -	$ 247,448,000	$ 265,712,000	$ 205,691,000	$ 340,339,000	$ 237,929,000	$ 276,987,000
Planning Engineering & Design (PED) Costs	$ -	$ 7,423,400	$ 7,971,400	$ 6,170,700	$ 10,210,200	$ 7,137,900	$ 8,309,600
Construction Management Costs	$ -	$ 14,846,900	$ 15,942,700	$ 12,341,500	$ 20,420,300	$ 14,275,700	$ 16,619,200
Fill Management Costs-Dike 12, 9 - 2009-2014	$ -	$ 7,227,000	$ 7,227,000	$ 7,227,000	$ 7,227,000	$ 7,227,000	$ 7,227,000
Lands, Easements, Rights Of Way, Relocations & Disposal Costs	$ -	$ -	$ -	$ -	$ -	$ 45,000	$ 45,000
Sediment Transportation Costs	$ -	$ 45,697,100	$ 41,493,500	$ 45,697,100	$ 41,893,800	$ 43,730,600	$ 43,730,600
Fish & Wildlife Mitigation	$ -	$ 500,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000
All Other Project Costs	$ -	$ 2,210,000	$ 2,210,100	$ 2,210,200	$ 2,210,100	$ 2,210,300	$ 2,210,000
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Total Implementation Costs	$ -	$ 325,352,400	$ 341,056,700	$ 279,837,500	$ 422,800,400	$ 313,055,500	$ 355,628,400
Current Value Of Implementation Costs	$ -	$ 325,352,400	$ 341,056,700	$ 279,837,500	$ 422,800,400	$ 313,055,500	$ 355,628,400
Plan Average Annual Costs	Plan 1	Plan 2	Plan 2a	Plan 3	Plan 3a	Plan 4	Plan 4a
						Corps	Locals
						Configuration	Configuration
	No	CDF 2 &	CDF 2A &	CDF 3 &	CDF 3A &	E 55th St &	E 55th St &
	Action	FMP	FMP	FMP	FMP	FMP	FMP
Investment Costs							
First Costs-Present Value	$ -	$ 254,389,200	$ 228,999,000	$ 217,701,200	$ 297,874,600	$ 205,004,600	$ 232,853,400
Interest During Construction (1)							
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Investment Costs	$ -	$ 254,389,200	$ 228,999,000	$ 217,701,200	$ 297,874,600	$ 205,004,600	$ 232,853,400
Average Annual Costs							
Investment Costs	$ -	$ 254,389,200	$ 228,999,000	$ 217,701,200	$ 297,874,600	$ 205,004,600	$ 232,853,400
Partial Payment Factor (2)	0.07771	0.07771	0.07771	0.07771	0.07771	0.07771	0.07771
Average Annual Costs	$ -	$ 19,768,900	$ 17,795,800	$ 16,917,800	$ 23,148,200	$ 15,931,100	$ 18,095,300
Annual Maintenance (3)	-	1,237,200	1,328,600	1,028,500	1,701,700	1,189,600	1,384,900
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Total Average Annual Costs	$ -	$ 21,006,100	$ 19,124,400	$ 17,946,300	$ 24,849,900	$ 17,120,700	$ 19,480,200
(1) There is no Interest During Construction since benefits accrue immediately							
(2) Partial Payment Factor based on 20 year project life and a 4 5/8% annual interest rate							
(3) Annual Maintenance taken as 0.5% of Contractors Earnings & Contingencies							

The Base Plan can include open lake placement as well as beneficial uses of dredged material. Information provided in Table 13 on costs indicates that the plan with the lowest average annual cost is Plan 4. Thus Plan 4 has been identified as the Base Plan.

All of the other plans that have been developed will be compared to this "Base" plan. This is important with respect to costs and cost sharing. The "Base Plan" identifies the level of costs the COE is willing to incur over the 20 year evaluation period (2009-2028). If the Selected Plan has costs higher than the Base Plan costs, the locals would be responsible for paying all costs above the Base Plan costs. Specific components of the selected Base Plan will now be discussed.

VI. DISCUSSION OF MAJOR "BASE PLAN" COMPONENTS/COSTS

The concept of the "Base Plan" is to identify future maintenance operations that would take place at Cleveland Harbor, assuming no DMMP study. The goal is to identify a dredging plan that is the least costly method of managing dredged material at the harbor over a 20 year time frame, is consistent with sound engineering practice and meets all Federal environmental standards established by the Clean Water Act of 1972 or Section 103 of the Marine Protection, Research And Sanctuaries Act of 1972, as amended. The "Base Plan" can also assess the potential for proposed beneficial uses of dredged material. These uses may be undertaken as separate plan elements, implementation being governed by the various authorities used. Open lake placement of sediments that meet Federal open lake standards can be part of the "Base Plan". These activities then become the "Base Plan" condition. All dredging alternatives developed by the DMMP would be compared to the "Base Plan".

The key components of the Base Plan are: implementation of the FMP at CDF 12 and 9 from 2009 through 2014, and construction of a new CDF at East 55th Street (Figure 12). The CDF is approximately 157 acres in size. To the south, the East 55th Street site will be bounded by an improved State Park Marina breakwater, the natural shoreline near the terminus of East 55th Street, and a to-be-constructed perimeter wall/dike. A portion of the eastern boundary would be formed by the existing First Energy circulating water intake (necessary improvements will be made to the structure) and the remainder of the perimeter shown will be formed by still to be constructed walls. The perimeter walls were costed out using back-to-back open cell construction.

The CDF will be constructed in three phases in order to spread out construction costs over time while still maintaining cost effectiveness. Cell size and sequencing has not yet been finalized but the combined footprint will not exceed what is shown in Figure 12. Anticipated storage capacity is 6,850,000 cubic yards, which will provide 20 years of capacity assuming an annual dredging volume of about 338,220 cubic yards per year. Again, the site would be developed in three phases. The first cell would be constructed from 2012 through 2014, allowing filling operations to begin in FY15. The second cell will be constructed from 2019 - 2021 and be ready for use in 2022. Cell 3 will be constructed from 2024 -2026 and be ready for use in 2027.

The proposed footprint of the East 55th Street site encroaches on the existing Federal approach channel in the east basin and eastern flared portion of the 25-foot deep dock approach channel to the former Nicholson Cleveland Terminal Company pier. These portions of the existing project were authorized but never constructed. These portions of the channel must be de-authorized in order to implement the proposed East 55th Street CDF alternative.

A. "Base Plan" Assumptions

The earliest the Cleveland Harbor DMMP can become implemented is 2009. The DMMP evaluation period is 20 years. Thus the DMMP evaluation period is from 2009 to 2028. The "Base Plan" condition needs to identify the various harbor maintenance activities that will take place from 2009 through 2028. This resulting time steam of activities, and associated costs, can then be converted to an average annual dollar value.

A number of pieces of information were identified in order to develop a time stream of future maintenance activities: the dredging cycle at Cleveland Harbor (yearly, every other year), cubic yards removed per dredging cycle, where the dredging takes place (approach channels, outer harbor, river), how many cubic yards of sediment are removed from various locations per dredging cycle, where the sediment is placed (open lake placement, CDF), existing CDF/open lake placement site capacities, when these sites will be filled, potential new sediment placement options (vertical or horizontal expansion at the current CDF, reclamation of space at the current CDF, development of a new upland placement site), when must these new facilities come on line, current best management practices, outfall relocation costs and other recurring costs associated with dredging (harbor facility surveys, harbor soundings, environmental studies, real estate management, economic studies, sediment sampling, environmental compliance studies, etc,).

All of the above were discussed with Cleveland Harbor field office personnel, who have the responsibility of overseeing dredging at Cleveland Harbor. Given the information developed from these meetings, a sequence of dredging operations, interim FMP, tasks needed to bring the new CDF sediment placement site on line by 2015, and other recurring studies associated with maintaining Cleveland Harbors authorized depths, were identified. The main assumptions and the timing of the main components needed to implement the Base Plan are provided in Table 14.

Given the timing of these components, costs were developed for each of these components. These tasks and their associated costs were placed into a 20-year time horizon- 2009-2028. Table 15 provides a summary of the time sequencing and costs of these tasks in current dollars. The major components of this plan will now be discussed.

B. Base Plan Dredging Quantities, Disposal Methods

The "Base Plan" assumes dredging of Cleveland Harbors authorized project dimensions every year. The Dredging Cycles for Cleveland Harbor over the Project Evaluation Period take place yearly from 2009 to 2028.

Table 14- Assumptions Used In Developing The "Base Plan" Condition For Cleveland Harbor

Dredging Cycle –Every Year	2009-2028
Average Cubic Yards Dredged Per Cycle At Cleveland Harbor	
Total Cubic Yards Removed Per Dredging Cycle	338,220
Cubic Yards Removed From Federal Channels	300,350
Cubic Yards Removed From Non Federal Channels	37,870
CDF Space/Open Lake Disposal Space And when Filled	
Space left (Cubic Yards) in CDF 10B	None
Year When CDF 10B Reaches Current Configuration Capacity	2008
Space Left In CDF 12	None
Space Left in CDF 9	None
Dredging Cycles- Sediment Placement-Yearly	
Open Lake Disposal	None
CDF Disposal	2009-2028
Dredging Costs	
Cost Per Cubic Yard To Place In CDF 12	$5.45
Cost Per Cubic Yard To Place In CDF 9	$5.35
Cost Per Cubic Yard To Place In New CDF- Cell 1	$5.65
Cost Per Cubic Yard To Place In New CDF- Cell 2&3	$5.55
Disposal Site Usage Practices-	
Best Operational Management Practices (BOMP) At Existing Cleveland CDF	
Fill Management Plan –CDF 12	2009, 2010, 2013, 2014
Fill Management plan CDF 9	2011,2012
Best Operational Management practices At New Outer Harbor CDF	2015-2028
Construction Of New CDF	
1. Site Recommendation	2008
2. Perform EIS And NEPA Coordination As Required By law	2009-2010
3. Develop And Execute Project Cooperation Agreement	2009-2010
4. Real Estate-Analysis & Acquisition	2009-2010
5. Perform Design Analysis	2010-2011, 2017-2018, 2022-2023
6. Develop Plans And Specs	2010-2011, 2017-2018, 2022-2023
7. Bid & Construction-Cell 1	2012-2013-2014
8. Bid & Construction Cell 2	2019-2020-2021
9. Bid & Construction Cell 3	2024-2025-2026
Fish Habitat Development	
Development of Fish Habitat	2014, 2021, 2026
Sediment Consolidation Practices	
Existing Cleveland CDF (CDF 10B, CDF 12, CDF 9)	2009-2014
New CDF	2015-2028
Other Recurring Activities	
Harbor Facility Condition Surveys- Yearly	2009-2028
Channel Soundings-Yearly	2009-2028
Environmental Studies-	2009, 2011, 2013, 2015, 2017, 2019, 2021, 2023, 2025, 2027
Economic Studies -	2009, 2014, 2019, 2024
Sediment Sampling -	2010, 2015, 2020, 2025
Environmental Compliance Studies	2010, 2015, 2020, 2025
Real Estate Management	2010, 2015, 2020, 2025
Active Solicitation Of Sediment Recycling And Beneficial Use Projects-Yearly	2009-2028

Table 15- Base Plan- Alternative Plan 4- Fill Management Plan, New CDF At Site 9-E 55th St. –Corps Configuration- Component Costs And Timing Of Expenditures

Base Plan-Management of Existing CDFs, Construction of CDF 9-E 55th St-Corps Configuration-BTBOC

Time Steam Of Plan Costs Over The Project Evaluation Period 2009-2028

			Plan, Design, Construct New Outer Harbor CDF						CDF 4-E 55th St.											
Evaluation Period	Calandar Year	Dredging Costs	FMP Dike 12, 9 For 09-14	EIS & NEPA Coordination	Develop & Execute PCA	Real Estate	Design Analysis	Construct Mangment Plans & Specs	Facility Costs Bid & Cnstrctn	Fish & Wildlife Mitigation	Best Management Practices Dike 12, 9 New CDF	Annual Harbor Surveys	Annual Channel Soundings	Envmmntl Studies	Economic Studies	Sediment Sampling	Envmmntl Compliance	Real Estate Mngmnt	Solicitation Sediment Recycling	Base Plan Plan 4- E 55th Costs In Current Dollars
1	2009	$ 1,698,900	$ 2,409,000	$ 100,000	$ 30,000	$ 22,500	$ -	$ -	$ -		$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000	$ -	$ -	$ -	$ 10,000	$ 4,373,400
2	2010	$ 1,698,900	$ -	$ 50,000	$ 30,000	$ 22,500	$ 1,656,750	$ 3,313,500	$ -		$ 10,000	$ 5,000	$ 43,000	$ -	$ -	$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 6,939,650
3	2011	$ 1,674,100	$ 2,409,000	$ -	$ -	$ -	$ 1,656,750	$ 3,313,500	$ -		$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ -	$ -	$ -	$ -	$ 10,000	$ 9,131,350
4	2012	$ 1,674,100	$ -	$ -	$ -	$ -	$ -	$ -	$ 36,816,700		$ 10,000	$ 5,000	$ 43,000	$ -	$ -	$ -	$ -	$ -	$ 10,000	$ 38,558,800
5	2013	$ 1,698,900	$ 2,409,000	$ -	$ -	$ -	$ -	$ -	$ 36,816,700		$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ -	$ -	$ -	$ -	$ 10,000	$ 41,002,600
6	2014	$ 2,520,200	$ -	$ -	$ -	$ -	$ -	$ -	$ 36,816,600	$ 166,700	$ 10,000	$ 5,000	$ 43,000	$ -	$ 35,000	$ -	$ -	$ -	$ 10,000	$ 39,606,500
7	2015	$ 2,599,800	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ -	$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,777,800
8	2016	$ 2,599,800	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ 10,000	$ 5,000	$ 43,000	$ -	$ -	$ -	$ -	$ -	$ 10,000	$ 2,667,800
9	2017	$ 2,599,800	$ -	$ -	$ -	$ -	$ 811,400	$ 1,622,800	$ -		$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ -	$ -	$ -	$ -	$ 10,000	$ 5,112,000
10	2018	$ 2,599,800	$ -	$ -	$ -	$ -	$ 811,400	$ 1,622,800	$ -		$ 10,000	$ 5,000	$ 43,000	$ -	$ -	$ -	$ -	$ -	$ 10,000	$ 5,102,000
11	2019	$ 2,599,800	$ -	$ -	$ -	$ -	$ -	$ -	$ 18,030,300		$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000	$ -	$ -	$ -	$ 10,000	$ 20,743,100
12	2020	$ 2,599,800	$ -	$ -	$ -	$ -	$ -	$ -	$ 18,030,300		$ 10,000	$ 5,000	$ 43,000	$ -	$ -	$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 20,798,100
13	2021	$ 2,174,100	$ -	$ -	$ -	$ -	$ -	$ -	$ 18,030,400	$ 166,700	$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ -	$ -	$ -	$ -	$ 10,000	$ 20,449,200
14	2022	$ 2,141,800	$ -	$ -	$ -	$ -	$ 1,100,800	$ 2,201,700	$ -		$ 10,000	$ 5,000	$ 43,000	$ -	$ -	$ -	$ -	$ -	$ 10,000	$ 5,512,300
15	2023	$ 2,141,800	$ -	$ -	$ -	$ -	$ 1,100,800	$ 2,201,700	$ -		$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ -	$ -	$ -	$ -	$ 10,000	$ 5,522,300
16	2024	$ 2,141,800	$ -	$ -	$ -	$ -	$ -	$ -	$ 24,462,700		$ 10,000	$ 5,000	$ 43,000	$ -	$ 35,000	$ -	$ -	$ -	$ 10,000	$ 26,707,500
17	2025	$ 2,141,800	$ -	$ -	$ -	$ -	$ -	$ -	$ 24,462,700		$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ -	$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 26,782,500
18	2026	$ 2,141,800	$ -	$ -	$ -	$ -	$ -	$ -	$ 24,462,600	$ 166,600	$ 10,000	$ 5,000	$ 43,000	$ -	$ -	$ -	$ -	$ -	$ 10,000	$ 26,839,000
19	2027	$ 2,141,800	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ -	$ -	$ -	$ -	$ 10,000	$ 2,219,800
20	2028	$ 2,141,800	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ 10,000	$ 5,000	$ 43,000	$ -	$ -	$ -	$ -	$ -	$ 10,000	$ 2,209,800
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Eval Period 2009-28		$ 43,730,600	$ 7,227,000	$ 150,000	$ 60,000	$ 45,000	$ 7,137,900	$ 14,276,000	$ 237,929,000	$ 500,000	$ 200,000	$ 100,000	$ 860,000	$ 100,000	$ 140,000	$ 340,000	$ 40,000	$ 20,000	$ 200,000	$ 313,055,500
										0										
Cmpnts as% Total		13.97%	2.31%	0.05%	0.02%	0.01%	2.28%	4.56%	76.00%	0.001597161	0.06%	0.03%	0.27%	0.03%	0.04%	0.11%	0.01%	0.01%	0.06%	100.00%

Average total cubic yards dredged per dredging cycle are placed at 338,220 cubic yards. This includes, on average, 300,350 cubic yards from Cleveland Harbor federal channels and 37,870 cubic yards removed from non-federal channels. All sediment dredged from Cleveland Harbor will be placed in a CDF. None of the sediment will be placed in an open lake disposal site unless future testing indicates that it is suitable for such placement and the Ohio state resource agencies are in concurrence relative to the Clean Water Act and the Ohio Coastal Zone Management Program. The total cubic yards of sediment that will be removed from Cleveland Harbor over the 20 year evaluation period is 6,764,400. The time stream of cubic yards dredged and method of disposal have been provided in Table 7.

Due to the current CDF capacity shortage, dredging will be reduced to 250,000 cubic yards per year (225,000 cubic yards Federal and 25,000 cubic yards non-Federal) until 2013. Dredging quantities would likely increase after 2014 to remove accumulated sediments (410,400 annually). Once the backlog has been removed (2020), annual dredging quantities will revert back to 330,200 cubic yards annually. This will result in, approximately 338,220 cubic yards being dredged annually during the twenty year study period. Again, all sediment dredged from Cleveland Harbor will be placed in a CDF. Approximately 6,764,400 cubic yards of sediment will be removed from Cleveland Harbor over the twenty year evaluation period (See Table 7).

All sediments dredged from 2009-2014 would be placed in CDF 12 and 9. All sediments dredged from 2015 to 2028 will be placed in the New CDF built at Site 9 (E 55th St. Site). Sediment placement costs for using CDF 12 (2009, 2010, 2013, and 2014) vary from $1,698,900 to $2,520,200 per dredging event. Sediment placement costs for using CDF 9 (2011, 2012) are approximately $1,674,100 per dredging event. Sediment placement costs for using the new CDF at Site 9 (E 55th Street) vary from $2,141,800 to $2,599,800 per dredging event.

C. Base Plan Management Practices Needed To Accommodate Dredging/Other Base Plan Implementation Components

The "Base Plan" employed a number of management practices to dispose of the sediment removed per cycle over the project evaluation period of 2009 to 2028. These management practices ranged from continued use of existing CDF, to intensive utilization of existing CDF to creation of a new outer harbor CDF. The management practices used to accommodate dredging from 2009 to 2028 will concentrate on where that sediment will be placed (into existing Cleveland Harbor CDF- 2009-2014- or into the new Base Plan CDF (2015-2028).

The CDF themselves will receive periodic Best Operational Management Practices that will optimize the amount of space the facility will provide. The facilities will also be managed to optimize dewatering and consolidation. These practices will include contouring the disposal site and trenching to promote optimal dewatering and will be performed every year.

Given the sediment removal schedule provided in Table 7, and that Site 10B is very near filled in its current configuration, "Base Plan" Best Operational Management Practices have been developed to provide enough capacity in existing Cleveland Harbor CDF (CDF 12 and CDF 9) and a new CDF at E. 55th Street to accommodate the sediment that will be dredged from 2009 through 2028. The Base Plan management practices include developing FMP for existing Cleveland Harbor CDF 12 and 9. The Base Plan also includes plans for new CDF construction. The management practices used to accommodate dredging from 2009 to 2028 will now be outlined by dredging cycle.

1. Management Practices For Dredging From 2009 Through 2014- It is anticipated that 250,000 cubic yards will be dredged each year from 2009 through 2013. Cubic yards removed in 2014 are estimated to be 410,400. The least expensive option for disposal of the dredge material is to maximize the usable space in existing CDFs. Usable space can be maximized through the use of Best Operational Management Practices (BOMPs).

One method to continue disposal at the current CDFs is to grade the in-place sediment to generate additional space. Dry sediment within the CDF is harvested to raise the perimeter elevations increasing capacity of the facility. In addition to the increased height of the perimeter, the area where sediment was harvested is now available for disposal of dredged material. Sediment used to raise the perimeter is graded to specific slope and elevation to maximize design capacity and meet design criteria. Trenches are dug to dewater the sediment more quickly and maximize sediment compaction.

Within the planning horizon (2009 - 2028), the first CDF site at Cleveland that would be used in this way is CDF 12. CDF 12 is located adjacent to BKL Airport. Any modifications to CDF 12 will consider the operational requirements of BKL Airport and comply with Federal Aviation Administration (FAA) regulations. FAA regulations limit the height and slope of the CDF perimeter. USACE has developed FMPs to maximize the capacity of existing CDFs while maintaining compliance with FAA regulations. A two-phase FMP has been developed for CDF 12 to accommodate approximately four dredging cycles (2009 through 2010 for Phase 1 and 2013 through 2014 for Phase 2).

The second CDF site at Cleveland that would be used in this way is CDF 9. Harbor CDF 9 is a 21-acre interim CDF with a design capability of 2.0 million cubic yards. Proposed berms will be constructed around the CDF using re-graded sediment currently within the CDF. The berms will tie into both CDF 10B and CDF 12 berms on the west and east sides of the CDF, respectively, to essentially create one large CDF to allow for more effective material deposition, decanting, and dewatering. Planned use of CDF 9 is in 2011 and 2012. Proposed fill management activities at CDFs 12 and 9 will provide disposal capacity from 2009 through 2014. By the year 2015 the East 55th Street site will be ready for use.

2. Management practices for Dredging From 2015 through 2028 Dredging Cycles - The remaining fourteen dredging cycles will remove a total of 5,104,000 cubic yards of dredged material. Sediment will be placed in the new East 55th Street site. The use of BOMPs at existing CDFs for a six year period (2009-2014) will allow sufficient time for the planning, design and construction of this new CDF for dredged material disposal at Cleveland. The E. 55th Street site will minimize construction costs since it will be constructed in relatively shallow water, be land based and sited adjacent to existing harbor navigation structures (i.e., piers, breakwaters).

3. Other Components of The Base Plan- Planning Evaluation Period 2009-2028

Fish Habitat Development, Sediment Consolidation Practices and “Other Recurring Costs”, as outlined in Table 14, are also part of the “Base Plan”. A Community Based Habitat Assessment (Species Richness) was performed for the entire final array of plans. A number of mitigation measures were identified that would be implemented under each plan to offset the loss of aquatic habitat. These measures included the development of vegetative habitat via “fish hotels”. Ten new ‘habitat areas” would be developed with each new habitat area being about 500 square feet in size. Sediment consolidation practices include working inside the CDF to improve water drainage and sediment consolidation. This can range from furrowing to creating drainage ditches to digging test holes to determine consolidation. ‘Other Recurring Costs” include such activities as: obtaining harbor facility condition inspections/facility surveys, channel soundings, sediment sampling and periodically performing baseline environmental, economic and real estate studies.

4. Active Solicitation Of Sediment Recycling And Beneficial Reuse Projects- Planning Evaluation Period 2009-2028 Ohio EPA and Ohio DNR have indicated that the sediment in Cleveland’s current CDF may be suitable for a wide range of reuses. The City of Cleveland and county officials have identified a number of potential uses of sediment in Cleveland’s existing CDF that range from usage as a cover for landfill, to a component in creating road aggregate for new road projects, to land cover. These types of sediment reuses would be actively pursued and requested. Starting in 2009, the City of Cleveland, Cuyahoga County officials and Ohio DOT would be asked each year for a list of potential projects where sediment currently in Cleveland’s CDF could be used. As their needs are identified, the required cubic yards of dry sediment would be calculated, and if economically feasible removed from the CDFs and transported to the new usage site. The volume of dry sediment removed would provide new storage space for sediment from future dredging operations.

VII. BASE PLAN AVERAGE ANNUAL IMPLEMENTATION COSTS

Table 15 provided a summary of Base Plan implementation costs by year over the 20 year project evaluation period: 2009-2028. Base Plan Costs identified include: annual harbor dredging costs; FMP implementation costs, costs associated with bringing the new CDF at East 55th Street on line by 2015 (NEPA coordination, Real Estate, PCA execution, Real Estate acquisitions, design analysis, plans and specifications, bid and construct facility), fish habitat development, best management practices, sewer outfall relocation costs and a range of recurring costs (annual harbor surveys, annual channel soundings, environmental and economic studies, sediment sampling, environmental compliance, real estate management, and active solicitation of sediment reuse projects). Costs associated with these components will now be discussed.

Dredging at Cleveland harbor over the 20 year project evaluation period (2009-2028) would take place every year. Dredging costs were developed by dredging cycle and were dependent on the number of cubic yards removed per cycle, and the ultimate placement of these sediments (existing CDF sites versus the new E. 55th Street site). Placement of sediment at existing CDFs (CDF 12 and CDF 9) ranged from $1,674,100 to $2,520,200 per dredging event. Costs associated with placing sediment at the new CDF location ranged from $2,141,800 to $2,599,800. Costs associated with putting sediments into the new CDF at Cell 1 (2015-2021) range from $2,174,100 to $2,599,800 per dredging event. Cost associated with putting the sediments into the new CDF at Cell 2 (2022-2026) range from $2,141,800 to $2,174,100 per dredging event. Cost associated with putting the sediments into the new CDF Cell 3 (2027-2034) are $2,141,800.

There are two water outfalls (a 42 inch diameter and a 14 foot diameter outfall) that will have to be extended approximately 1,000 feet. Extension of these outfalls have a total cost $7,591,500 and would take place in two stages. The first extension would start in 2014 ($5,091,500) and the second extension ($2,500,000) in 2021.

“Base Plan” CDF construction costs are $237,929,000. Construction of the new CDF facility at E. 55th St will take place in three phases. Construction of Cell 1 would take place in approximately 25 feet of water, be constructed over a three year period (2012, 2013, 2014), and cost $110,450,000. Construction of Cell 2 would take place in approximately 28 feet of water, be constructed over a three year period (2019, 2020, 2021), and cost $54,091,000. Construction of Cell 3 would take place in approximately 28 feet of water, be constructed over a three year period (2024, 2025, 2026), and cost $73,388,000.

Major components of this effort include: perform NEPA coordination (2009-$100,000 and 2010-$50,000), Real Estate evaluations (2009-$22,500, 2010-$22,500) develop and execute local PCA (2009-$30,000, 2010-$30,000), Design Analysis (Cell 1- 2010-$1,656,750, 2011-$1,656,750; Cell 2- 2017-$811,400, 2018-$811,400; Cell 3- 2022-$1,100,800, 2023-$1,100,800), develop Plans and Specifications (Cell 1- 2010-$3,313,500, 2010-$3,313,500; Cell 2- 2017-$1,622,800, 2018-$1,622,800; Cell 3- 2022-$2,201,700, 2023-$2,201,700); and bid and construction (Cell 1-2012-$36,816,700, 2013-$36,816,700, 2014-$36,816,600; Cell 2-2019-$18,030,300, 2020-$18,030,300, 2021-$18,030,400; Cell 3-2024-$24,462,700, 2025-$24,462,700, 2026-$24,462,600).

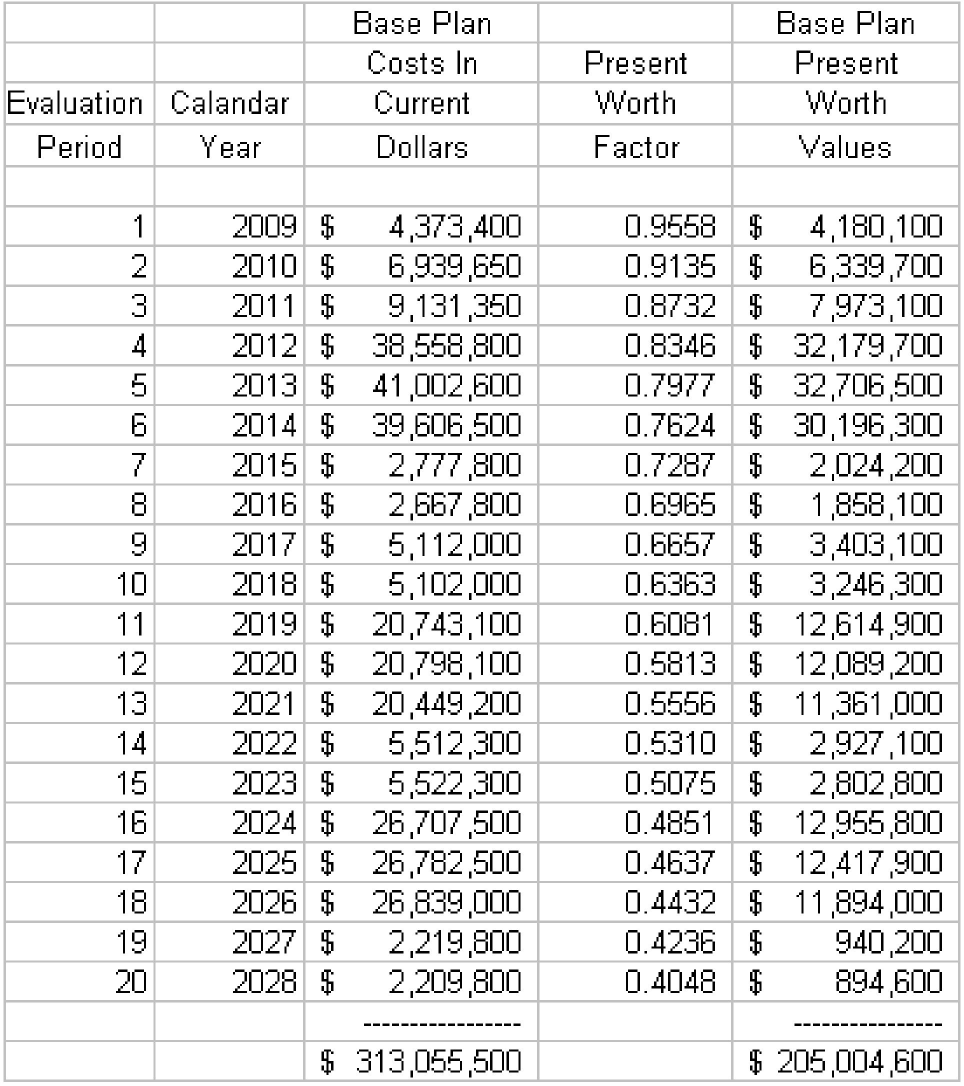
Fish habitat development will take place by building 10 fish habitats, each being approximately 500 square feet. The exact location of the new habitats, located throughout the outer harbor, will be developed in conjunction with ODNR, USFWS, and the City of Cleveland during the design phase of the study. It is anticipated that they will attract all of the species currently found in the harbor, and would also attract those fish species found at the site just outside of the harbor. Total costs for the new habitat development is $500,000, which will take place in 2014 ($166,700), 2021 ($166,700) and 2026 ($166,600).

Other Recurring costs include: sediment consolidation practices ($10,000) performed every year starting in 2009, yearly harbor facility condition surveys ($5,000), yearly channel soundings

($43,000), environmental studies ($10,000) scheduled for every other year starting in 2009, Economic studies ($35,000) performed once every five years starting in 2009, periodic sediment sampling ($85,000) performed once every five years starting in 2010 , environmental compliance ($10,000) performed once every five years starting in 2010, real estate management ($5,000) taking place once every 5 years starting in 2010, and yearly solicitation of sediment reuse projects ($5,000).

All of the above costs were placed into a time stream and summed over the year they occurred in (see Table 15). These summed expenditures by project year were then discounted to present worth values using the FY 09 Federal Discount Rate of 4.625 percent. These present worth values were then summed. This process is presented in Table 16. The present worth of these costs came to $205,004,600.

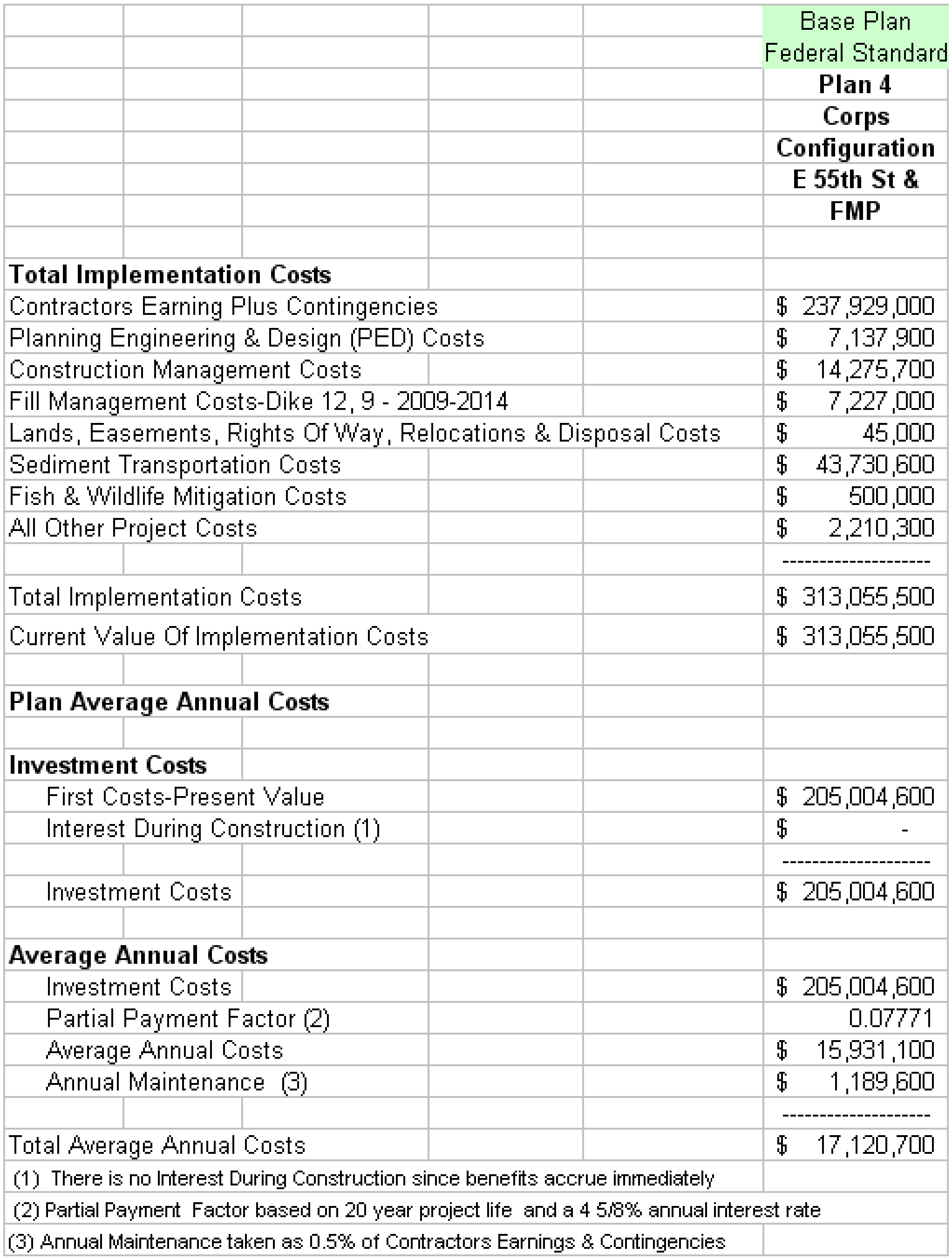
Table 16- Base Plan Component Costs-Present Worth Values



Evaluation Period	Calandar Year	Base Plan Costs In Current Dollars	Present Worth Factor	Base Plan Present Worth Values
1	2009	$ 4,373,400	0.9558	$ 4,180,100
2	2010	$ 6,939,650	0.9135	$ 6,339,700
3	2011	$ 9,131,350	0.8732	$ 7,973,100
4	2012	$ 38,558,800	0.8346	$ 32,179,700
5	2013	$ 41,002,600	0.7977	$ 32,706,500
6	2014	$ 39,606,500	0.7624	$ 30,196,300
7	2015	$ 2,777,800	0.7287	$ 2,024,200
8	2016	$ 2,667,800	0.6965	$ 1,858,100
9	2017	$ 5,112,000	0.6657	$ 3,403,100
10	2018	$ 5,102,000	0.6363	$ 3,246,300
11	2019	$ 20,743,100	0.6081	$ 12,614,900
12	2020	$ 20,798,100	0.5813	$ 12,089,200
13	2021	$ 20,449,200	0.5556	$ 11,361,000
14	2022	$ 5,512,300	0.5310	$ 2,927,100
15	2023	$ 5,522,300	0.5075	$ 2,802,800
16	2024	$ 26,707,500	0.4851	$ 12,955,800
17	2025	$ 26,782,500	0.4637	$ 12,417,900
18	2026	$ 26,839,000	0.4432	$ 11,894,000
19	2027	$ 2,219,800	0.4236	$ 940,200
20	2028	$ 2,209,800	0.4048	$ 894,600
		-----------------		----------------
		$ 313,055,500		$ 205,004,600

These present worth values for the Base plan represent an estimate of Project Implementation Costs. Interest During Construction was added to Project Implementation Costs to calculate Investment Costs. Since project benefits accrue immediately at project year one, there is no Interest During Construction costs associated with the Base Plan. Total Investment Costs were converted to an average annual basis using the water resources Federal discount rate of 4.625 percent, based on a 20 year project life. Annual maintenance costs were calculated as a Percentage of Contractors Earnings and Contingencies. Table 17 provides Average Annual Costs associated with the Base Plan. Base Plan average annual costs are $17,097,900.

Table 17. Base Plan Average Annual Costs



	Base Plan Federal Standard **Plan 4 Corps Configuration E 55th St & FMP**
Total Implementation Costs	
Contractors Earning Plus Contingencies	$ 237,929,000
Planning Engineering & Design (PED) Costs	$ 7,137,900
Construction Management Costs	$ 14,275,700
Fill Management Costs-Dike 12, 9 - 2009-2014	$ 7,227,000
Lands, Easements, Rights Of Way, Relocations & Disposal Costs	$ 45,000
Sediment Transportation Costs	$ 43,730,600
Fish & Wildlife Mitigation Costs	$ 500,000
All Other Project Costs	$ 2,210,300

Total Implementation Costs	$ 313,055,500
Current Value Of Implementation Costs	$ 313,055,500
Plan Average Annual Costs	
Investment Costs	
First Costs-Present Value	$ 205,004,600
Interest During Construction (1)	$ -

Investment Costs	$ 205,004,600
Average Annual Costs	
Investment Costs	$ 205,004,600
Partial Payment Factor (2)	0.07771
Average Annual Costs	$ 15,931,100
Annual Maintenance (3)	$ 1,189,600

Total Average Annual Costs	$ 17,120,700
(1) There is no Interest During Construction since benefits accrue immediately	
(2) Partial Payment Factor based on 20 year project life and a 4 5/8% annual interest rate	
(3) Annual Maintenance taken as 0.5% of Contractors Earnings & Contingencies	

VIII. BASE PLAN SUMMARY

In summary, 6,764,4000 cubic yards of sediment will be dredged at Cleveland Harbor over the project evaluation period (2009-2028). All sediments will be placed in Confined Disposal Facilities.

Vertical expansion of Cleveland Harbors current CDFs (CDF 12 and CDF 9) will accommodate sediment containment needs associated with the 2009-2014 dredging cycles. Sediment that needs to be placed in a CDF from all remaining dredging cycles (2015-2028) will be placed in the new CDF created at East 55th Street.

Fish Habitat Development, Best Management Practices, Sediment Consolidation Practices, Other Recurring Costs and Sediment Reuse Projects, as outlined in Table 15, are also part of the "Base Plan". Any reuse/recycling projects that arise during the project evaluation period will be considered for implementation, especially if their cost per cubic yard of reuse is less than CDF construction costs per cubic yard. Base Plan Implementation Costs in current dollars are \$313,055,500. The present worth of these Base Plan implementation costs are \$205,004,600. The average annual costs associated with implementing the Base Plan are \$17,120,700.

APPENDIX B

PRELIMINARY ASSESSMENT

DEPARTMENT OF DEFENSE
UNITED STATES OF AMERICA

DEPARTMENT OF THE ARMY
BUFFALO DISTRICT, CORPS OF ENGINEERS
1776 NIAGARA STREET
BUFFALO, NEW YORK 14207-3199
March 3, 2004

REPLY TO
ATTENTION OF
CELRB-PM-PM

CLEVELAND HARBOR, OHIO
DREDGED MATERIAL MANAGEMENT PLAN
PRELIMINARY ASSESSMENT
SUMMARY OF FINDINGS AND RECOMMENDATIONS

Executive Summary:

The purpose of this preliminary assessment is to answer the following two questions: (1) “Is Cleveland Harbor economically viable?”, and (2) “Is there enough space available to hold twenty years of dredged material from Cleveland Harbor?”

Economic viability exists when the benefit to cost ratio is greater than 1.0. An evaluation of just the key Cleveland Harbor receipts of iron ore and stone shows that the benefit to cost ratio is 4.8. Considering only stone, the benefit to cost ratio is still 1.3. Therefore, the continued operation and maintenance of the Cleveland Harbor Federal channel is economically justified. While other bulk commodity benefits at Cleveland Harbor exist, they have not been addressed in this assessment.

Assuming that all sediment dredged will be placed in Confined Disposal Facilities (CDF), that no new beneficial reuses will be found to recycle materials in the Confined Disposal Facility, the space in the existing Federal CDF Dike 10B will be exhausted in approximately 2008, assuming the placement of 330,200 cubic yards per year into the facility. Consequently, USACE will need to work with Cleveland Harbor stakeholders to formulate a Dredged Material Management Plan (DMMP), including interim disposal alternatives and a long term solution to manage dredged material for, at least, the next twenty years.

Section 1 provides a description of the project, and section 2 identifies the project authority. Section 3 provides an economic assessment, describing the harbor and dock locations, bulk traffic at Cleveland Harbor, the future of iron ore movements at Cleveland Harbor, commercial boat traffic, and maintenance dredging. A historical and projected future of maintenance dredging is provided in section 4. Section 5 describes dredged material disposal site capacities and operation and maintenance needs for the open-lake disposal sites, near shore disposal sites, and confined disposal facilities. Section 6 addresses planning and environmental compliance issues. Conclusions and recommendations are provided in sections 7 and 8, respectively.

1. PROJECT NAME AND DESCRIPTION

Cleveland Harbor, Cuyahoga County, Ohio (PWI 003430), is located on the south shore of Lake Erie at the mouth of the Cuyahoga River. The port is 28 miles east of Lorain, Ohio and 33 miles west of Fairport, Ohio (Figure 1). Cleveland Harbor is a major commercial port on Lake Erie. Cleveland Harbor tonnages in 2000 were 14,391,000 short tons and in 2002 11,400,000 short tons. Iron ore and limestone account for 76% of the ports activity. Iron ore receipts (6,746,000 short tons in 2000) are received at Cuyahoga River docks located near the head of navigation and on Whiskey Island for transshipment to inland steel plants. Limestone receipts (4,115,000 short tons in 2000) are destined for docks located on the Old River, and the middle and upper portion of the Cuyahoga River. The limestone is used by a local steel company and the building trades.

The harbor consists of a lakefront, breakwater protected outer harbor (Figure 2) and an inner harbor (Figure 3). The inner harbor is the lower deep draft section of the Cuyahoga River, and the connecting Old River. Authorized and maintained channel dimensions are presented in Table 1.

TABLE 1
AUTHORIZED AND MAINTAINED CHANNEL DIMENSIONS (LWD)

CWIS NUMBER	REACH OR SEGMENT	NOMINAL CHANNEL DEPTH		NOMINAL CHANNEL WIDTH		MAX. SAILING DRAFT	PROJECT SPONSOR
		(as auth.)	(as maint.)	(as auth.)	(as maint.)		
10060	Lake Approach	29'	29'	600'-750'	600'-750'	29'	N
	Outer Harbor West Basin	28'	28'	1,500'	1,500'	28'	N
	Outer Harbor East Basin	28'-25'	28'-25'	Varies 1,500'-500'	Varies 1,500'-500'	28'-25'	N
	Cuyahoga River	23'	23'	Varies 130'-325'	Varies 130'-325'	23'	N
	Old River	27'	23'-21'	200'-400'	200'-400'	23'-21'	N
	Turning Basins	18'	18'	690'	690'	--	N

The outer harbor is a breakwall-protected area of about 1,300 acres. The outer harbor is 5 miles long, 1,600 to 2,400 feet wide, composed of an east breakwater (20,970 feet long) and a shore connected west breakwater (6,048 feet long). There is a 201-foot gap in the West breakwater about 662 feet from the shore end. The main entrance channel has east and west arrowhead breakwaters, both of which are 1,250 feet long. The arrowhead breakwaters are 600 feet apart.

Figure 1- Cleveland Harbor Location

Location On Lake Erie

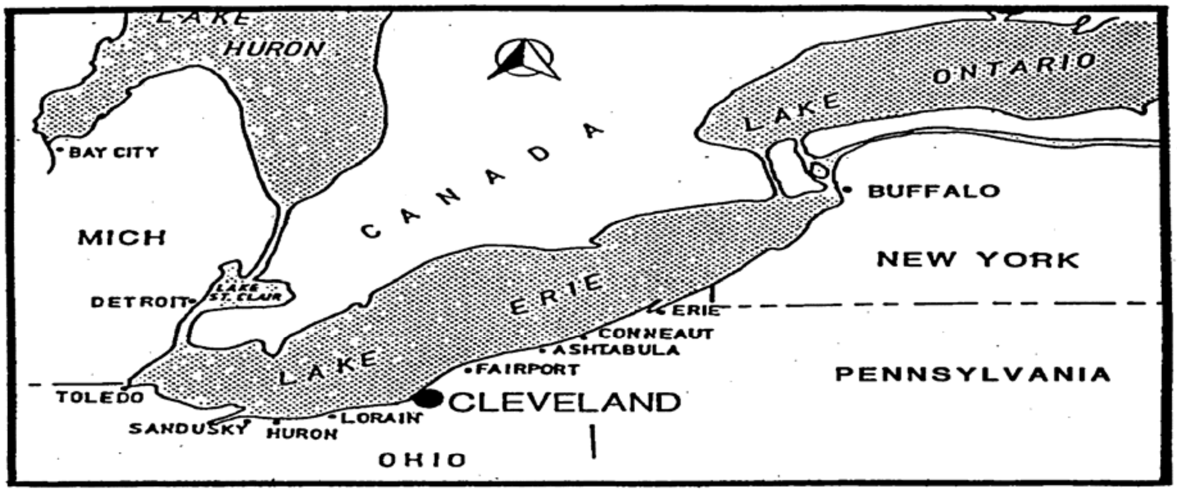


FIGURE 1

LOCATION MAP

Great Lakes Ports

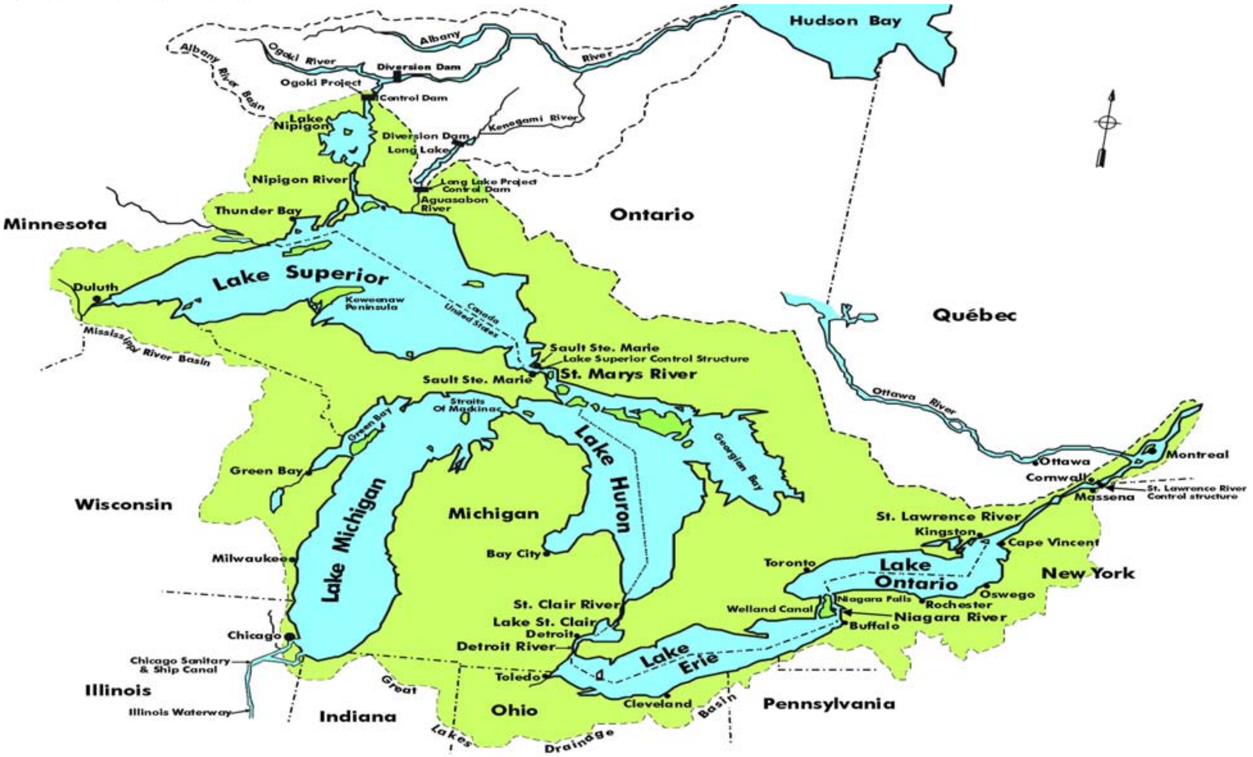


Figure 2.- Cleveland Harbor - Outer Harbor

Cleveland Harbor- Outer Harbor

Outer Harbor- Looking East

Figure 3. Cleveland Harbor- Inner Harbor

Old River

Cuyahoga River

The inner harbor includes the lower 5.8 miles of the Cuyahoga River and approximately one mile of the Old River. The Cuyahoga River is in line with the main entrance to the outer harbor from the lake. The entrance channel is protected by two parallel piers, 325 feet apart. The width of the Cuyahoga River varies from 130 to 325 feet. A turning basin is located approximately 4.8 miles upstream of the Cuyahoga Rivers mouth. The Old River extends westward from a point about 0.4 miles above the mouth of the Cuyahoga River. The Old River varies in width from 200 to 400 feet.

There are two entrances to the outer harbor. The main entrance (the Lake Approach Entrance Channel) is located between the east and west breakwater. The other entrance is at the east end of the east basin, between the east breakwater and the shore. Authorized channel depths in these entrance areas are at least are 29 feet below Low Water Datum (LWD). LWD for Lake Erie is 569.2 feet above mean sea level as measured at Rimouski, Province of Quebec, Canada, IGLD 85. Authorized channel depths in the outer harbor are 28 feet below LWD in the west basin and 28 to 25 feet in the east basin.

The project provides an authorized navigation channel depth of 27 feet in the lowermost part of the Cuyahoga River, from the lakeward end of the piers to a point immediately above the junction with the Old River. Authorized channel depths in the remaining portions of the Cuyahoga River are 23 feet. The Old River navigation channel is maintained to 23 and 21 feet.

Cleveland Harbor is dredged every year. The average dredging volume per dredging event since 1998 is 330,200 cubic yards.

2. AUTHORITY

The existing Federal project was authorized by the 1875, 1886, 1888, 1896, 1899, 1902, 1907, 1910, 1916, 1917, 1935, 1937, 1945, 1946, 1958, 1960 and 1962 River and Harbor Acts and the 1976 Water Resources Development Act.

The project as modified by the 1976 Water Resources Development Act authorized preparation of a Reformulation Phase I Design Memorandum completed in July 1984. Further improvements in the interest of commercial navigation and recreational navigation were authorized in the 1985 Supplemental Appropriations Act (PL-99-88). The commercial navigation improvements of this authorization are on hold.

The 1989 Energy and Water Development Appropriations Act (PL 101-101) authorized the Corps to begin a reconnaissance study of the Cuyahoga River to address the concerns of boat traffic congestion and related risks, accidents and safety of the public. Preliminary plans were studied to alleviate the commercial navigation problem and inadequate channel width and depth in the Old River and the Cuyahoga River. The reconnaissance report recommended a feasibility study for one plan comprised of three structural features. The study is classified as "inactive".

The current project improvements at Cleveland Harbor are 90 percent complete, exclusive of inactive and deferred portions of the project. Work remaining to complete the project consists of the following: 1- enlarging and deepening to 31 feet LWD the east entrance channel, deepening the east basin to 27 feet LWD; 2- the 1960 Rivers and Harbors Act, Stage

II, provided for the deepening of the remainder of the Cuyahoga River from Bridge No. 1 to and including the Old River, has been classified as deferred; 3- the 1958 Rivers and Harbors Act, provided for the planning for the replacement of Bridges 19 and 32, and for the widening of the Cuyahoga and Old River channels, has been classified as deferred; and 4, the 1946 Rivers and Harbors Act provided for the widening of the Cuyahoga River at the downstream end of cut 4, has been classified as inactive.

3. ECONOMIC ASSESSMENT

Information on the original justification of the commercial navigation project is not available.

Waterborne traffic at Cleveland Harbor consists primarily of receipt and shipment of bulk commodities. In 2000, total tonnage at Cleveland Harbor was 14,391,000 tons (Table 2). Receipts accounted for 93% (13,372,000 tons) and shipments accounted for 7% (1,019,000 tons) of all traffic.

TABLE 2
COMPARISON OF CLEVELAND HARBOR AND GREAT LAKES WATERBORNE COMMERCE DATA
1990 & 2000

CARGO TONNAGE (NET TONS)

Year	Cleveland Harbor	% Change	Great Lakes	% Change
1990[1]	14,368,000	0.16%	167,140,000	12.17%
2000[2]	14,391,000		187,490,000	

MAJOR COMMODITIES

Commodity	Year	Cleveland Harbor	% Change	Great Lakes	% Change
Iron Ore	1990[1]	8,767,000	-23.05%	66,806,000	3.19%
Iron Ore	2000[2]	6,746,000		68,941,000	
Limestone	1990[1]	2,470,000	66.60%	24,457,000	24.51%
Limestone	2000[2]	4,115,000		30,451,000	
Cement & Concrete	1990[1]	436,000	50.00%	4,428,000	59.42%
Cement & Concrete	2000[2]	654,000		7,059,000	
Salt	1990[1]	523,000	9.94%	2,956,000	43.13%
Salt	2000[2]	575,000		4,231,000	
Sand, Gravel, & Crushed Rock	1990[1]	179,000	134.08%	3,808,000	73.71%
Sand, Gravel & Crushed Rock	2000[2]	419,000		6,615,000	

1. Waterborne Commerce Of the United States, Calendar Year 1990, Part 3-Waterways and Harbors Great Lakes, Department of the Army, Corps of Engineers.
2. Waterborne Commerce Of the United States, Calendar Year 2000, Part 3-Waterways and Harbors Great Lakes, Department of the Army, Corps of Engineers.

Iron ore has been the dominant commodity moving through Cleveland Harbor. In 2000 iron ore movements accounted for 47% (6,746,000 tons) of all traffic at Cleveland Harbor. The other significant commodity was limestone (4,115,000), which accounted for 29% of the harbors bulk traffic. Other major commodities using Cleveland harbor include: cement and concrete (5%), salt (4%) and sand, gravel and crushed rock (3%).

The waterborne traffic pattern at Cleveland Harbor has varied in the ten years from 1991 through 2000. Bulk commodity traffic has ranged from a low of 13.4 million tons during the recession of 1991 to a high of 18.1 million tons in 1997. Waterborne traffic at the harbor in the future will be near the 12,000,000 tons per year level. The "base load" traffic at the harbor will determine the economic viability of Cleveland Harbor as a Federally maintained harbor.

The Buffalo District recently assessed the economic viability of Cleveland Harbor (Dredging Evaluation, Cleveland Harbor Ohio, March 2003), as part of its on-going program of assessing the economic viability of harbor maintenance for its commercial harbors (Table 3). As part of that evaluation a “base load” of future traffic that utilizes the harbor was projected. This “base load” of future traffic volumes assumes the continuance of iron ore receipts and limestone receipts in the range of receipts that took place in the year 2000. The evaluation was based on the receipt of two commodities: iron ore and limestone. The estimated annual tonnage for these two commodities was placed at 10,350,000 tons. This figure was arrived at through discussions with the individual commercial dock owners. The harbor is projected to receive annually 4,800,000 tons of iron ore and 5,550,000 tons of stone. The ”base load” of future traffic volumes assumes continued receipt of iron ore at the harbor, the majority of which is destined for the integrated steel plant located at the head of navigation on the Cuyahoga River.

**TABLE 3: DREDGING EVALUATION OF CLEVELAND HARBOR-
AVERAGE ANNUAL BENEFITS, AVERAGE ANNUAL DREDGING COSTS,
NET BENEFITS AND B/C [1]**

Commodity	AAE Benefits [2]	AAE Costs [3]	AAE Net Benefits	Benefit/Cost Ratio
Stone [4]	$2,387,200	$1,903,000	$484,200	1.25
Iron Ore [5]	$6,709,000	$1,903,000	$4,806,000	3.53
Stone & Iron Ore [6]	$9,096,200	$1,903,000	$7,193,200	4.78

1. Based on “Dredging Evaluation, Cleveland Harbor Ohio, March 2003”. The evaluation looked at maintaining current harbor depths of 28 feet in the outer harbor and 23 feet in the inner harbor. The evaluation looked at the 20 year period 2003 to 2022, used a 5 7/8% annual interest rate and was in March 2003 prices.
2. AAE Benefits are additive. AAE Net Benefits must be computed by subtracting AAE Costs from AAE Benefits for each benefit category. There is only one set of dredging costs and that value is applicable to all combinations of traffic forecasts.
3. Average Annual dredging costs are based on dredging 270,000 cubic yards annually over the 20-year evaluation period.
4. Traffic is based on stone receipts only. Stone receipts were placed at 5,550,000 tons annually over the 20-year evaluation period.
5. Traffic is based on iron ore receipts only. Iron ore receipts were placed at 4,800,000 tons annually over the 20-year evaluation period.
6. Traffic is based on iron ore and stone receipts Both receipts totaled 10,350,000 tons annually over the 20-year evaluation period.

The above mentioned economic evaluation of dredging at Cleveland Harbor concluded that dredging of the harbor every year, with removal of 270,000 cubic yards of material every year over a 20 year evaluation period, was economically justified with three different traffic scenarios: 1) receipt only of stone (5,550,000 tons per year) had a BC ratio of 1.25; 2) receipt only of iron ore (at 4,800,000 tons per year) had a BC ratio of 3.53 and; 3) receipt of stone and iron ore (10,350,000) had a BC ratio of 4.78. Table 3 presents the results of the evaluation for maintaining current harbor channel depths (28 feet in the outer harbor and 23 feet in the inner harbor), given the three different traffic scenarios.

a. Harbor Description, Dock Locations

Cleveland Harbors lakefront is very well protected by its east and west breakwaters that extend along the lakefront for a distance of about 5 miles. Vessels enter the harbor via the lake approach channel (600 feet in width) which leads to the outer harbor area. The main channel in the outer harbor leads directly to the Cuyahoga River.

Recreational boating is the most visible form of recreation in the Cleveland Harbor area. Major marinas are located along the Lakefront Harbor's east basin, immediately west of the west breakwater, and at the upper end of the Old River. These facilities accommodate thousands of recreational vessels. Considerable recreational boating activity (including cruising, water-skiing and fishing) occurs both within and outside the Harbor area. Harbor cruises are also available to the general public on the tour ship Goodtime II.

There are forty-eight piers, wharves and docks described in the report " Port Series No. 43, Revised 2000, The Port of Cleveland Ohio" prepared by the Water Resources Support Center of the U.S. Army Corps Of Engineers. Twelve are located in the east and west basins of the Outer Harbor. Six are located along the banks of the Old River. The right and left banks of the Cuyahoga River have 14 and 16 facilities each, respectively.

The location, ownership and type of commodity movements taking place at the more active Cleveland Harbor docks will be discussed. The discussion will focus around the five major bulk commodities using Cleveland Harbor: Iron ore, limestone, cement and concrete, salt and sand and gravel.

Iron ore Iron ore receipts in 2000 were 6,746,000 tons and accounted for 47% of the Harbors total traffic. There are two main destinations of iron ore at Cleveland Harbor. Most of the iron ore received at Cleveland Harbor has historically been destined for the integrated steel mill situated in the City of Cleveland, about 5 miles up the Cuyahoga River. The facility has three docks that it uses for the receipt of iron ore. The Cleveland steel mill was owned and operated by LTV Steel through the previous decade but LTV went bankrupt in 2001. In 2002 the mill was sold and was restarted by the International Steel Group, known as ISG Steel.

The second major destination of iron ore in Cleveland Harbor is a transshipment facility located on Whiskey Island, in the Western Basin. The dock is known as the "C & P" or the "Lakefront" dock. Oglebay Norton Terminals, Inc currently operates the dock. The dock is physically located on the north shore of Whiskey Island 0.6 miles west of the Cuyahoga River Entrance Channel. Greenwood's reports that it has a length of 1,875 feet, which can accommodate two Class 7 or one Class 10 boat; and has storage capacity for 1,000,000 tons of iron ore. The channel depth at the dock is reported to be 27 feet.

The dock receives approximately 1,000,000 tons of iron ore annually which is destined for Weirton Steel, which operates a mill at Steubenville, Ohio and Weirton, West Virginia. The two mills are actually one operating facility lying on either side of the Ohio River. The ore is transported from the Lakeside dock to Steubenville\Weirton by ConRail (and its successor); Norfolk Southern runs the former ConRail Cleveland-Steubenville/Weirton Line. The

Cleveland Port Authority has purchased the iron ore transshipment facility equipment located at Lorain Ohio and intends to move it to Whiskey Island. Oglebay Norton will operate the transshipment facility called the Cleveland Bulk Terminal (CBT).

Limestone Limestone receipts were the second largest commodity using Cleveland Harbor. Limestone receipts in 2000 were 4,115,000 tons and accounted for 29% of the Harbors total traffic. There were ten major docks active in the limestone trade in 2000. Limestone receipts have three major destinations in Cleveland Harbor: docks on the Old River, docks on the middle portion of the Cuyahoga River (from the Carter Road Bridge to the upper end of the turning basin –river mile 4.8) and the ISG steel mill located 5.0 miles up the Cuyahoga River. The major receiver of limestone on the Old River is Ontario Stone Corporation. They have three docks located on the Old River that receive limestone. Their main dock is located at the intersection of the Old and Cuyahoga Rivers. ISG steel has two docks located on the upper portion of the Cuyahoga River that receive limestone.

Cement And Concrete Cement and concrete receipts at Cleveland harbor in 2000 were 654,000 tons. The four major docks engaged in this trade are located on the Old River and the Lower Cuyahoga River (Mouth of the Cuyahoga River up to the Carter Road Bridge).

Salt Salt is the major export of Cleveland Harbor (575,000 tons in 2000). Cargill Salt Division operates a salt dock located on the left bank of the Old River approximately 1,300 feet below the head of navigation. This dock is used to load rock salt for shipment to U.S. and Canadian cities located on the Great Lakes for industrial and road de-icing uses.

Sand And Gravel Sand And Gravel receipts at Cleveland harbor in 2000 were 419,000 tons. There are four major docks engaged in this trade located on the Old River and the Middle Cuyahoga River.

b. Bulk Traffic at Cleveland Harbor

Table 2 presented a snapshot of bulk waterborne traffic at Cleveland Harbor in 1990 and 2000. In the year 2000, Cleveland Harbor handled the most commercial traffic of all 11 commercial Federal Harbors on Lake Erie: 14,391,000 tons. In the eleven years from 1990 through 2000, traffic varied from a low of 13.4 million tons during the recession of 1991 to a high of 18.1 million tons in 1997.

Receipts dominate freight movement at Cleveland Harbor. Receipts accounted for 93% of all movements at Cleveland Harbor in 2000. The receipt of two commodities dominates the traffic movements in Cleveland Harbor: iron ore and limestone. Other major commodities that use the harbor are cement and concrete; salt; and sand, gravel and crushed rock.

Iron ore receipts in 2000 were 6,746,000 tons. Most of the iron ore received at Cleveland Harbor has historically been destined for the integrated steel mill situated in the City of Cleveland, located approximately 5 miles up the Cuyahoga River. The Cleveland steel mill, formerly owned and operated by LTV Steel, was sold to the International Steel Group (ISG) in 2002. The outer harbor area (Whiskey Island) receives approximately 1,000,000 tons of iron ore, destined for Weirton Steel's integrated mill at Steubenville, Ohio/Weirton, West Virginia.

Limestone receipts in 2000 were 4,115,000 tons. The limestone received at the harbor is overwhelmingly destined for the construction industry. A comparatively small amount is consumed by ISG in charging its two blast furnaces. The limestone received at Cleveland is distributed throughout northeastern Ohio.

Cement and concrete and sand and gravel receipts in 2000 were 654,000 and 419,000 tons respectively. These commodities are destined fro the local area construction industry.

The main export of Cleveland Harbor is salt. Salt exports in 2000 were 575,000 tons. Rock salt is mined at Cleveland and shipped out to many U.S. and Canadian cities situated on the Great Lakes.

Future levels of tonnages using Cleveland Harbor were developed based on the strength of the industries using the bulk commodity. The level of tonnages moving through Cleveland Harbor should continue at a level of about 12,000,000 tons per year. These tonnage levels assume continued operation of the ISG integrated steel mill at Cleveland, continued operation of the Steubenville/Weirton Steel Mill in Ohio and West Virginia and sourcing of its iron ore needs through Cleveland Harbor, continued steady demand for bulk commodities used in the construction industry and continued operation of the salt mines at Cleveland Harbor.

c. The Future of Iron Ore Receipts at Cleveland Harbor

There are numerous factors that will ultimately determine the future of iron ore receipts at Cleveland Harbor. All factors are tied to the viability of the two steel plants that use Cleveland Harbor iron ore receipts: the ISG Steel mill located in Cleveland, and the Weirton Steel Mill located in Steubenville Ohio/Weirton West Virginia. The most significant factors for the steel mills are the steel-making costs at these facilities, legislative tariffs and foreign and domestic competition.

2001 was an extremely difficult year for the US integrated steel industry. A number of mills closed and others downsized. The parent company of the steel mill in Cleveland (at that time LTV Steel) filed for chapter 11 in December 2000 and closed steel making operations at the Cleveland plant in 2001. In May 2002, all the assets of LTV Steel were bought by the International Steel Group (ISG). ISG now owned LTV’s two integrated steel mills - the mill in East Chicago (Indiana Harbor), Indiana, and the Cleveland Works mill in Cleveland, Ohio. Since that time, ISG has restarted steel making operations at both of LTV’s former plants in Cleveland and Chicago.

ISG is the second largest integrated steel maker in North America. Since April 2002, ISG has acquired LTV and Acme Steel, as well as the assets of Bethlehem Steel (May 2003) which include two operating integrated steel mills-the Burns Harbor Mill in East Chicago Indiana and the Sparrows Point mill outside of Baltimore Maryland. These acquisitions have resulted in an integrated steel making company capable of producing over sixteen million tons of steel annually. ISG has made labor and management cuts at its steel making facilities, negotiated a new labor contract, streamlined production and instituted new management approaches which have increased steel making productivity and have made ISG one of the lowest cost steel producers in the United States. There is no question that the ISG mill in Cleveland will continue producing steel for the foreseeable future and that it will continue to receive iron ore.

Weirton Steel Corporation has its steel making operations in Steubenville Ohio and Weirton West Virginia. The company receives iron ore from Cleveland's outer harbor docks located on Whiskey Island. The company is the sixth largest integrated U.S. steel company and employs 3,500 people. The company produces hot rolled, cold rolled, galvanized and tin mill products (TMP). It is the nations second largest TMP producer.

While the future of Weirton Steel is not as certain, it is projected that it also will continue to receive iron ore from Cleveland Harbor. The company went through a major restructuring in 2001 and 2002. Cost cutting measures were implemented including job eliminations and reduction of its public debt. New labor agreements were negotiated in 2003. Weirton Steel voluntarily entered Chapter 11 creditor protection in May 2003. It will maintain control and ownership of its assets as opposed to having a court appointed trustee operate the company. It has secured a $225m debtor in possession (DIP) financing to cover its working capital needs during this time. The reorganization will allow the company to improve its liquidity and address its legacy costs.

In the spring of 2002, President Bush imposed a three-year tariff on specific steel imports. This tariff would help eliminate the unfair price advantage foreign steel had in the domestic steel market. The tariff was 30% in the first year. However, the tariff was not 30% for the entire three years. It is 30% for year one, 24% for year two, and 18% for year three, after which it expires.

The tariff scale imposed by President Bush bought the US integrated steel industry up to three years of time in which to reorganize and become more competitive. Reorganization" essentially means combining the larger; more efficient US integrated mills into a smaller number of larger and more efficient producers. The remaining smaller integrated mills need to implement cost cutting measures and become more competitive. However, the tariffs were removed in February 2004.

Another round of tariff protection is not likely to be implemented given the complaints, both domestic and foreign, raised against the current protective tariff. Even if another protective tariff were implemented, it would not protect the older, less efficient smaller integrated mills from the aggressive competition of the electric arc based US mini steel mills.

d. Commercial Fleet Traffic

Waterborne traffic at Cleveland Harbor should continue near the 12,000,000 tons per year range. Cleveland Harbor has a strong base of tonnage in iron ore and limestone receipts. The iron ore needs of the ISG steel plant at Cleveland and the steel mill complex at Steubenville/Weirton, will continue to be serviced through Cleveland Harbor. The strong and stable demand of the building products industry for limestone also contributes to the Harbors projected tonnage levels. A general outline of fleet traffic that will be used to deliver the basic bulk commodities will now be discussed.

Iron ore receipts at Cleveland go to two locations, the transshipment facility located on Whiskey Island and the ISG steel plant located at the head of navigation on the Cuyahoga River. All iron ore delivered to ISG docks will be delivered in Class 5 vessels. This is the maximum sized vessel that can navigate the various bends of the Cuyahoga River. Iron ore delivered to Whiskey Island in the Western Basin will include Class 5,7,8 and 10 vessels. These vessels will be able to take advantage of the deeper vessel drafts that are possible in the Outer Harbor area (28 feet LWD in the Western Basin).

Limestone receipts typically originate from ports located on Lake Huron (60% of all harbor limestone receipts) and Lake Erie (40% of all harbor limestone receipts.). Since these vessels deliver limestone to docks located on the Old River and the Cuyahoga River, they will be limited to Class 5 vessels.

Cement and Concrete is typically delivered to docks located on the Old River and the Lower Cuyahoga River (The area from the mouth of the Cuyahoga up to the Carter Road Bridge). Cement carriers are a specialized type of vessel which relies on shoreside equipment to unload the cargo. Vessel Classes 2, 3 and 4 will typically be used to deliver this commodity.

Salt is the major commodity shipped from Cleveland Harbor. All salt shipments from Cleveland harbor originate from the upper end of the Old River. The navigation channel in this area is maintained to 21 feet LWD. Vessels engaged in the salt trade are typically Class 5 vessels. An overwhelming majority of these vessels have mid summer drafts less than 23 feet.

There is a very active construction aggregates trade at Cleveland Harbor, which receives sand, gravel and crushed stone. These commodities are characteristically delivered to docks located on the Old River and the Middle Cuyahoga (The area between the Carter Road Bridge and the upper end of the turning basin –river mile 4.8). The vast majority of the tonnage is carried in class 5 vessels (98%) with the remainder being delivered by class 1 vessels.

e. Maintenance Dredging at Cleveland Harbor

Currently, Cleveland Harbor is dredged every year. All material dredged from Cleveland Harbor is deposited in a Confined Disposal Facility (CDF). The need to dredge portions of the Outer harbor, the Old River and the Cuyahoga River depends upon the continued operation of the various docks that receive the major bulk commodities that use Cleveland Harbor: iron ore, limestone, cement and concrete, salt, and sand, gravel and crushed rock.

The recently completed Operations and Maintenance report (March 2003) indicated dredging of the Cuyahoga River, the Old River and the Outer Harbor to its currently maintained depths is economically justified (See Table 3- Dredging Evaluation Of Cleveland Harbor). The report went further and looked at the justification of continued harbor dredging under the unlikely event that all iron ore receipts at Cleveland Harbor ceased. The report indicated that dredging of the Cuyahoga River, the Old River and the Outer Harbor would still be economically justified even with the cessation of all iron ore receipts to the harbor. The report did not investigate the reduction in cubic yards dredged that this would induce since continued maintenance of the entire Cuyahoga River would no longer be needed. This in turn would reduce the amount of dredged material that would be removed from the river channel and also, the amount of material that must be placed in the Confined Disposal Facility (CDF).

At this time, the Dredge Material Management Plan developed for Cleveland Harbor should assume that all channels and channel depths currently being maintained on the Cuyahoga River, Old River and Outer Harbor area will continue to be maintained. It should also assume continued receipt of iron ore at the harbor. It should assume iron ore will continue to be delivered to the ISG steel mill located at the head of commercial navigation on the Cuyahoga River and to Whiskey Island in the western basin for transshipment to the steel mill located at Steubenville/Weirton.

4. MAINTENANCE DREDGING: HISTORICAL AND PROJECTED FUTURE

The need for maintenance dredging arises from the buildup of shoal material in the navigation channels which leads to the restriction of the flow of commercial navigation. On average, dredging of the Federal channels from 1998 to 2003 resulted in 293,500 cubic yards of material being removed during each dredging event. These cubic yards represent "In Place" volumes. "In Place" volumes are calculated by using channel bottom soundings that are taken before dredging takes place and channel bottom soundings that are taken after dredging has taken place. The difference in the two channel sounding elevations are "In Place" volumes.

Dredging of Non-federal channels during this same time period resulted in an average of 36,700 in place cubic yards being removed per dredging event. Average total in place cubic yards removed (Federal and Non federal) per dredging event for the time period 1998-2003 was 330,200 (Table 4).

TABLE 4.
RECENT DREDGING HISTORY (IN PLACE CUBIC YARDS PER YEAR [1])

	Year 1998	Year 1999	Year 2000	Year 2001	Year 2002	Year 2003	Average	Disposal Site
Federal Dredging	335,900	281,700	225,600	401,800	182,000 2	333,900 3	293,500	CDF
Non Federal	24,700	25,100	107,400	23,700	11,800	27,600	36,700	CDF
Total Dredging	360,600	306,800	333,000	425,500	193,800	361,500	330,200	CDF

1. All volumes are "In Place" volumes.
2. Dredging operations were limited by available funds. Actual quantities dredged in 2002 do not necessarily reflect the required dredging volumes if sufficient O&M appropriations were available.
3. Preliminary estimate of in place Federal cubic yards dredged in 2003.

Table 5 presents Federal costs for dredging Cleveland Harbor in the recent past. Federal costs have averaged $1,829,000 per dredging event for the five Federal dredging events in the 1998-2002 interval.

TABLE 5
CHANNEL MAINTENANCE COST HISTORY

Reach or Segment	Construction/ Acquisition		Dredging Cost[1]					
	Year	Cost		1998	1999	2000	2001	2002	Average [2]
Entire Harbor			Dredging	$1,604,300	$1,841,900	$1,499,700	$2,446,900	$1,752,000	$1,829,000

1. All dredging costs are in current dollars as of the year expended. All dredging costs are those costs associated with Federal dredging only.

These costs do not include Non Federal dredging costs.

2. Average reflects costs per dredging event for Federal dredging costs only.

Table 6 presents the future dredging schedule with the anticipated volume of material that will be dredged. Approximately 293,500 in place cubic yards are to be removed each year from 2004 to 2013 under Federal channel maintenance. Non-federal dredging needs during this time frame were placed at 36,700 in place cubic yards annually. These are the average number of in place cubic yards removed by Federal and Non-federal users over the six-year period 1998 to 2003. These projections of dredging quantities presumes continuation of present conditions - with continued receipt of iron ore at the ISG steel mill on the Cuyahoga River and at Weirton Steels facility in Steubenville/Weirton. These facilities combined receive approximately 4.8 million tons of iron ore annually through Cleveland Harbor.

TABLE 6
ANTICIPATED DREDGING

Reach or Segment	Programmed Dredging ("In Place" Cubic Yards-000's, consistent with 10-year O &M maintenance plan and historical Non Federal dredging needs)											Disposal Sites to be Used
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Average	
Federal Dredging	293.5	293.5	293.5	293.5	293.5	293.5	293.5	293.5	293.5	293.5	293.5	Confined Disposal
Non Federal Dredging	36.7	36.7	36.7	36.7	36.7	36.7	36.7	36.7	36.7	36.7	36.7	Confined Disposal
Total Dredging	330.2	330.2	330.2	330.2	330.2	330.2	330.2	330.2	330.2	330.2	330.2	Confined Disposal

Table 7 presents future Federal dredging costs. Federal dredging is projected to remove, on average, 293,500 in place cubic yards per dredging event each year during the 10-year interval 2004 to 2013. This projection of Federal dredging costs presumes continuation of present conditions - with continued production of hot metal at the ISG steel mill and continued reception of 4.8 million tons of iron ore per year at the harbor. The average total Federal cost per dredging event is projected to be $1,707,000.

TABLE 7
FEDERAL CHANNEL MAINTENANCE COST PROJECTIONS

Programmed Federal Dredging Cost ($000's per year, consistent with 10-year project O&M maintenance schedule)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Average.[1]
Federal Dredging	$1,700	$1,700	$1.700	$1,700	$1,700	$1,700	$1,700	$1,700	$1,700	$1,700	$1,700
Economic Evaluation	$35	$0	$0	$0	$0	$35	$0	$0	$0	$0	$7
Total:	$1,735	$1,700	$1,700	$1,700	$1,700	$1,735	$1,700	$1,700	$1,700	$1,700	$1,707

1. Average total dredging cost per dredging event. All dredging costs are those costs associated with Federal dredging only.

These costs do not include Non Federal dredging costs.

5. DREDGED MATERIAL DISPOSAL SITE CAPACITY AND USAGE

a. Open-Lake Disposal Site

The Cleveland Harbor open-lake disposal site (1,280 acres in area) is located 9 miles north of the east arrowhead breakwater. Since 1970, almost all dredged material from the harbor has been discharged into Confined Disposal Facilities located at Cleveland Harbor because tests of dredged materials indicates unsuitability for open lake disposal.

b. Nearshore Disposal Sites

The vast majority of dredged material from Cleveland Harbor has been determined to be not suitable for nearshore disposal.

c. Confined Disposal Facility

The U.S. Army Corps Of Engineers, Buffalo District, in coordination with the U.S. Environmental Protection Agency and Ohio EPA have determined that, with the exception of some sandy material which accumulates at the upstream limit of the Cuyahoga River channel that may be used as beach nourishment material depending upon most recent test results, sediments dredged from Federal navigation channels at Cleveland Harbor would not be open lake disposed. All dredged material is placed in Confined Disposal Facilities.

Virtually all of the material dredged between 1970 and 1974 was placed in two dike disposal areas constructed in the late 1960s. Public Law 91-611 in 1970 authorized the construction of spoil disposal facilities for a period to not exceed 10 years. Two facilities were built: Site 12 and Dike 14 opposite Gordon Park.

Dike 14 is an 88-acre facility with an estimated capacity of 6,130,000 cubic yards. This site was turned over to the non Federal Sponsor in 1999. The site at that time was 95% filled.

A new CDF (Site 10B) was completed in 1998 adjacent to the Burke Lakefront Airport (Table 8). The Dike 10B footprint is 68 acres and cost $17,500,000 to build. The actual physical inside capacity of the facility covers 58 acres. The 58-acre site provides storage for

TABLE 8
SITE 10B DISPOSAL SITE DATA

Disposal Site(s) (Name or Identifier)	Site Type	Disposal Site Capacity		Beneficial Uses (CY/Year)		Other Users	Disposal Site Sponsor (Y/N)
		Physical Capacity (CY)	Percent Filled	Existing	Anticipated		
CDF	Confined Disposal	2,900,000 [1]	Being Evaluated	None	None	N/A	Y

1. Based on a recent capacity evaluation performed by the Buffalo District (January 2004). Site 10 B has a 68 acre footprint. Usable acres for storage of dredged material is 58 acres. The 2,900,000 cubic yard capacity does not reflect the existence of sewage pipe passing through the CDF, which reduces the sites storage capacity by 60,000 cubic yards.

2,900,000 cubic yards of in place sediment. This CDF provides approximately 11 years of storage capacity assuming the placement of 330,200 in place cubic yards annually between 2004 and 2008, and a consolidation factor of .78. A study is currently underway to determine its remaining capacity.

All deep water aquatic habitat within the CDF's 68-acre footprint will eventually be filled-in with dredged material and therefore, be eliminated from further utilization by fish as spawning and/or feeding habitat. Displacement of benthic and planktonic organisms and associated habitat, and loss of aquatic submergent vegetation will also occur. However, the submerged outside portion of the CDF dike exposed to the lake proper, will provide about 9 acres of irregular long-term stone substrate as habitat for fish, benthic invertebrate and planktonic colonization. Submerged stone along the inside slope of the dike will also provide substrate for benthic and planktonic colonization. Submerged stone on outside dike slopes of the CDF will provide long-term hard substrate for aquatic vegetation, specifically filamentous algae. Eventual conversion of the deep water site to terrestrial land, if left undeveloped, would become invaded with native grasses, forbs, shrubs, and trees.

In recent years, since 1998, all sediment dredged at Cleveland Harbor has been deposited in Site 10B. (Table 9).

TABLE 9.
PLACEMENT HISTORY [1]

	Year 1998	Year 1999	Year 2000	Year 2001	Year 2002	Year 2003	Average	Disposal Site
Federal Dredging	335,900	281,700	225,600	401,800	182,000 [2]	333,900 [3]	293,500	CDF
Non Federal	24,700	25,100	107,400	23,700	11,800	27,600	36,700	CDF
Total Dredging	360,600	306,800	333,000	425,500	193,800	361,500	330,200	CDF

1. All volumes are "In Place" volumes.
2. Dredging operations were limited by available funds. Actual quantities dredged in 2002 do not necessarily reflect the required dredging volumes if sufficient O&M appropriations were available.
3. Preliminary estimate of in place Federal cubic yards dredged in 2003.

Mechanical or hydraulic dredges are generally used to dredge the navigation channels. Dredged material is deposited into the CDF.

6. ENVIRONMENTAL COMPLIANCE

National Environmental Policy Act (NEPA) documents which evaluate existing dredging and discharge activities for Cleveland Harbor are listed in Table 10. The Buffalo District will remain in compliance with applicable environmental laws and regulations for dredging and dredged material disposal at Cleveland Harbor.

TABLE 10
PROJECT COMPLIANCE

Harbor Reach & Discharge Site(s)	Document	Date	Expiration Date	Scheduled Update
Diked Disposal Site No. 12	FEIS	1973-74	-	-
Operations & Maintenance	FEIS	April 1974	-	-
Diked Disposal Facility Site No. 14	FEIS	December 1975	-	-
Diked Disposal Facility Site No. 14	Statement of Findings	February 1976	-	-
Diked Disposal Facility Site No. 14	Supplemental Information Report	January 1980	-	-
Littoral Drift Nourishment at Bratenahl and Perkins Beach	EA/FONSI	February 1985	-	-
Modification to Dike 14 CDF	FEIS	September 1993	-	-
Modification to Dike 14 CDF	Record of Decision	December 1993	-	-
Confined Disposal Facility (Site 10B – 15-Year)	FEIS	March 1994	-	-
Confined Disposal Facility (Site 10B – 15-Year)	Record of Decision	August 1994	-	-
Operations & Maintenance Dredging & Discharge into Dike 10B	Section 401 Water Quality Certification	March 2003	March 2004	March 2004

The major problem relating to dredging at the harbor is that Dike 10B, originally projected to reach capacity in 2013, is now expected to reach capacity in 2008. Lower lake levels, increased quantities of Federal dredging, dredging by private entities, and other factors, have reduced the lifespan of the CDF.

CDF Dike 10B, located adjacent to, and to the north of, Burke Lakefront Airport was completed in 1998. However, construction of the South Perimeter Wall/Berm, a component of the original design, was deferred for Value Engineering purposes. The actual physical capacity, with the berm in-place, of the CDF is estimated to be 2,900,000 cubic yards less the space occupied by the storm sewers within the dike. Usage of the design capacity of the Dike is now thought to be possible through dredge material management where excavating equipment would be used to contour dry dredged material. The future management of dredge material in Dike 10B could begin as soon as FY05. The future management of dredge material placed into Dike 10B would allow for complete utilization of Dike 10 B's design capacity.

Investigations are underway, including topographic and marine surveys, that will more precisely estimate dredged material settlement and consolidation, and the year Dike 10B is likely to reach design capacity. Preliminary results indicate that Dike 10 B will reach capacity in 2008, presuming approximately 330,200 cubic yards of dredged material is placed annually.

A Final Environmental Impact Statement was completed for the construction of Dike 10B in 1994. The south perimeter dike was part of the original design and was therefore evaluated in the 1994 FEIS. It is the opinion of Buffalo District that the construction of the dike is in compliance with NEPA. Therefore, the District Environmental Coordinator distributed a Record of Environmental Consideration for public comment as the method of coordination and determined that a “categorical exclusion” for the proposed Dike 10B operational Filling Management Plan is appropriate.

Required documents for future activities would depend on the dredging and discharge methods selected, expansion of dredging limits, updated information on sediment contamination levels, changes to or expansion of the CDF or significant changes in existing environmental conditions. The Buffalo District normally conducts sediment analyses every five years. The EIS for harbor operations and maintenance activities is updated via an environmental assessment or Supplement to the EIS when these activities substantially change or significant new information on the environmental effects of these activities becomes available.

Future environmental compliance requirements could include NEPA documentation, Section 404(b)(1) evaluation, Section 401 State Water Quality Certification, and Ohio Coastal Management (CZM) Program Federal Consistency Determination.

7. CONCLUSIONS

Cleveland Harbor is economically viable as documented in this assessment. In addition, there is insufficient space in the operational CDF, Dike 10B, to hold dredged material for the next 20 years.

The Cleveland CDF Dike 10B is rapidly approaching capacity. The facility, initially projected to have a fifteen-year life (1999 thru 2013), is currently projected to reach capacity in 2008, presuming annual dredged material placement is approximately 330,200 cubic yards. There are several factors that affect the useful life of Dike 10B, including the decision to cease placement of material into Dike 14 which has remaining capacity; placement of dredged materials into Dike 10B in 1998; significantly greater quantities of Federal dredging materials; larger quantities of non-Federal dredging placement into Dike 10B; impacts of larger quantities on settlement and consolidation rates; and changes in dredged material composition that also affect settlement and consolidation rates.

The quantity of dredged material placed into Dike 10B must be closely managed over the next four years to minimize quantities while meeting the needs of commercial navigation. Federal and non-Federal dredged material placement must be minimized to extend the remaining life of the facility. Less annual quantity will reduce ‘lifts’ which will have a beneficial impact on settlement and consolidation rates, tending to increase remaining capacity.

Meanwhile, planning efforts are underway for interim disposal solutions during the years following Dike 10B reaching capacity and before a new twenty-year CDF becomes operational. Solutions would likely include upland disposal, evaluating the capacity of former CDFs 9, 12, and 13 to accept additional dredged material, and potential beneficial reuse of dredged material. Expansion of Dike 12 vertically is considered a likely course of action. Although there is remaining capacity in Dike 14, municipal and state agencies are pursuing a course of recreational and wildlife use of that facility and the conclusion is not to pursue detailed investigation of that option.

The long term, twenty-year CDF, is projected to be available for receipt of dredged material in the year 2013. The management plan developed during the DMMP must reflect community desires for the Cleveland Lakefront and meet the requirements for the Federal Aviation Administration for safe operation of Burke Lakefront Airport.

The challenge of uninterrupted navigation channel maintenance dredging at Cleveland Harbor requires effective communication and coordination among the various regulatory agencies, customers and stakeholders to ensure technical approach and solutions consensus. The critical challenges are financing improvements, avian management, consistency with lakefront development plans, and a cost-effective twenty-year dredged materials management solution. Balancing competing requirements and ensuring that effective strategies are in motion will assure uninterrupted operations at Cleveland Harbor.

TABLE 11
CONCLUSIONS

The ability to maintain this project for the next 20 years is limited by:	
Disposal Site Capacity	Y
Economic Viability	N
Environmental Compliance	N

8. RECOMMENDATIONS

Significant issues to the continued maintenance of this project have been identified in this assessment, conducted during the Phase I DMMP investigation. A study proposal for the development of a Dredged Material Management Plan is underway along with a cost estimate. I recommend that the Phase II DMMP investigation be initiated to develop a long term (twenty year) solution of dredged material disposal at Cleveland Harbor.

JEFFREY M. HALL
LTC, EN

Commanding

APPENDIX C

SCOPE OF WORK

Scope of Work

Cleveland Harbor, Ohio

Dredge Material Management Plan

February 2004

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1. PROJECT DESCRIPTION

Cleveland Harbor is located within the central basin of Lake Erie on the south shore at the mouth of the Cuyahoga River in Cuyahoga County, Ohio (Figure 1). The harbor is 191 miles southwest of Buffalo, NY and 110 miles east of Toledo, OH.

Included in the project are the Outer Harbor and Cuyahoga River Channels (Figure 2). The harbor measures about 1,300 acres, is 5 miles long and varies in width between 1,600 to 2,400 feet. The harbor is protected by a breakwater system: an east breakwater (20,970 feet long), a west breakwater (6,048 feet long), and the east and west arrowhead breakwaters (each measuring 1,250 feet). Authorized depths in this area range from 25 to 28 feet. The East and West Arrowhead Breakwater protect the Lake Approach Channel with an authorized depth of 29 feet. The Entrance Channel varies in width from 750 to 220 feet and is maintained at an authorized depth of 28 feet to the mouth of the Cuyahoga River. The lower Cuyahoga River Channel, from the lakeward side of the piers to immediately above the Old River confluence, is maintained to an authorized depth of 27 feet. The upper Cuyahoga River and turning basin are maintained to an authorized depth of 23 feet and 18 feet respectively. A confined disposal facility (CDF) is also situated in the outer harbor.

The Cleveland Harbor Dredged Material Management Plan (DMMP) is a five-year project that will include management of existing disposal sites to extend their useful life and address specific measures necessary to mange the volume of material likely to be dredged over the next twenty years. The policy of the U.S. Army Corps of Engineers (USACE) is to accomplish the disposal of dredged material associated with the operation and maintenance dredging of Federal navigation projects in the least costly manner that is consistent with sound engineering practices and environmental standards.

2. AUTHORIZATION AND DEVELOPMENT HISTORY

Cleveland Harbor, Ohio, was initially authorized as a Federal harbor by congress in the River and Harbor Act of 1875. The 1875 authorization was modified in 1886, 1888, 1896, 1899, 1902, 1907, 1910, 1916, 1917, 1935, 1937, 1945, 1946, 1958, 1960, and 1962 River and Harbor Acts. The project also authorized under the 1976 and 1986 Water Resource Development Acts (WRDA), the 1985 Supplemental Appropriations Act, and the 1988 Energy and Water Appropriations Act. The role of the USACE, as established by law, is to provide safe, reliable, and efficient waterborne transportation systems for movement of commerce, national security, and recreation. Maintenance of Federal navigation improvements at harbors such as Cleveland, OH, is the responsibility of the USACE. Historically, the USACE has utilized a number of dredged disposal methods for sediments dredged from Federal harbors including unconfined open water disposal and disposal into a CDF. A CDF refers to a site where specific dredged materials are confined because of their potential for the release of contaminants into open water. The existing CDF at Cleveland Harbor is located in the outer harbor and was completed in 1998. It is 58 acres and has a design capacity of approximately 2,900,000 cubic yards. WRDA 1986 (P.L. 99-662), Section 201, as amended by WRDA 1996, established the cost sharing provisions for harbors. The non-Federal sponsor for the confined disposal facility shall contribute 25% of the cost of construction during the period of construction and an additional 10%, plus interest, over a period not to exceed thirty years.

Figure 1. Cleveland Harbor location map.

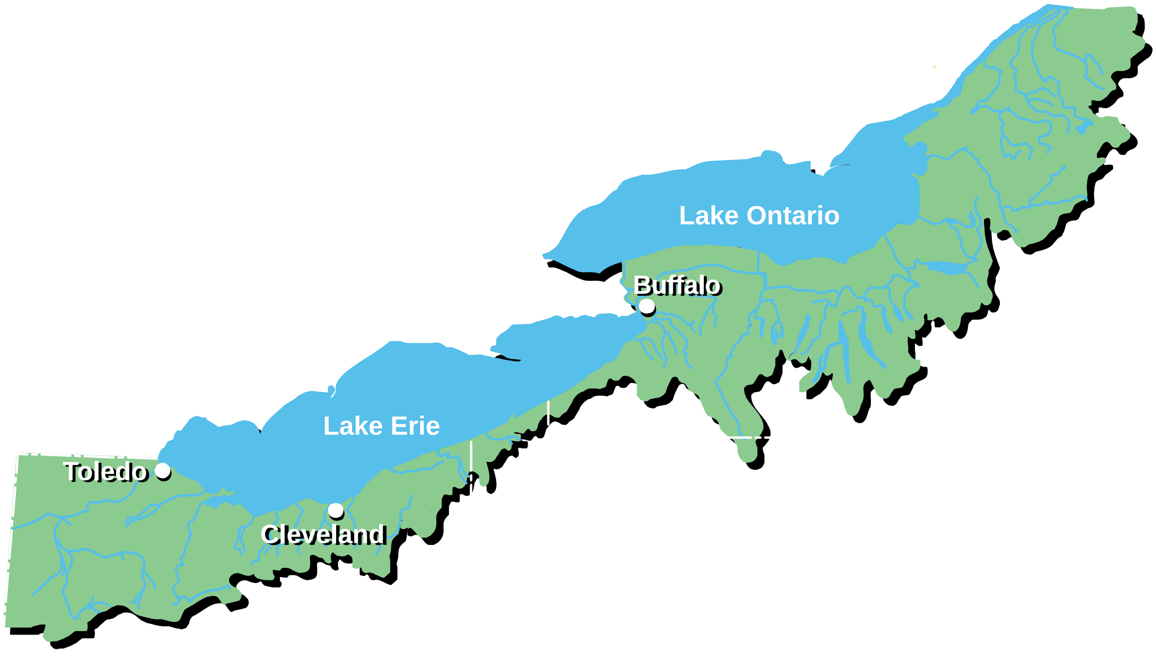
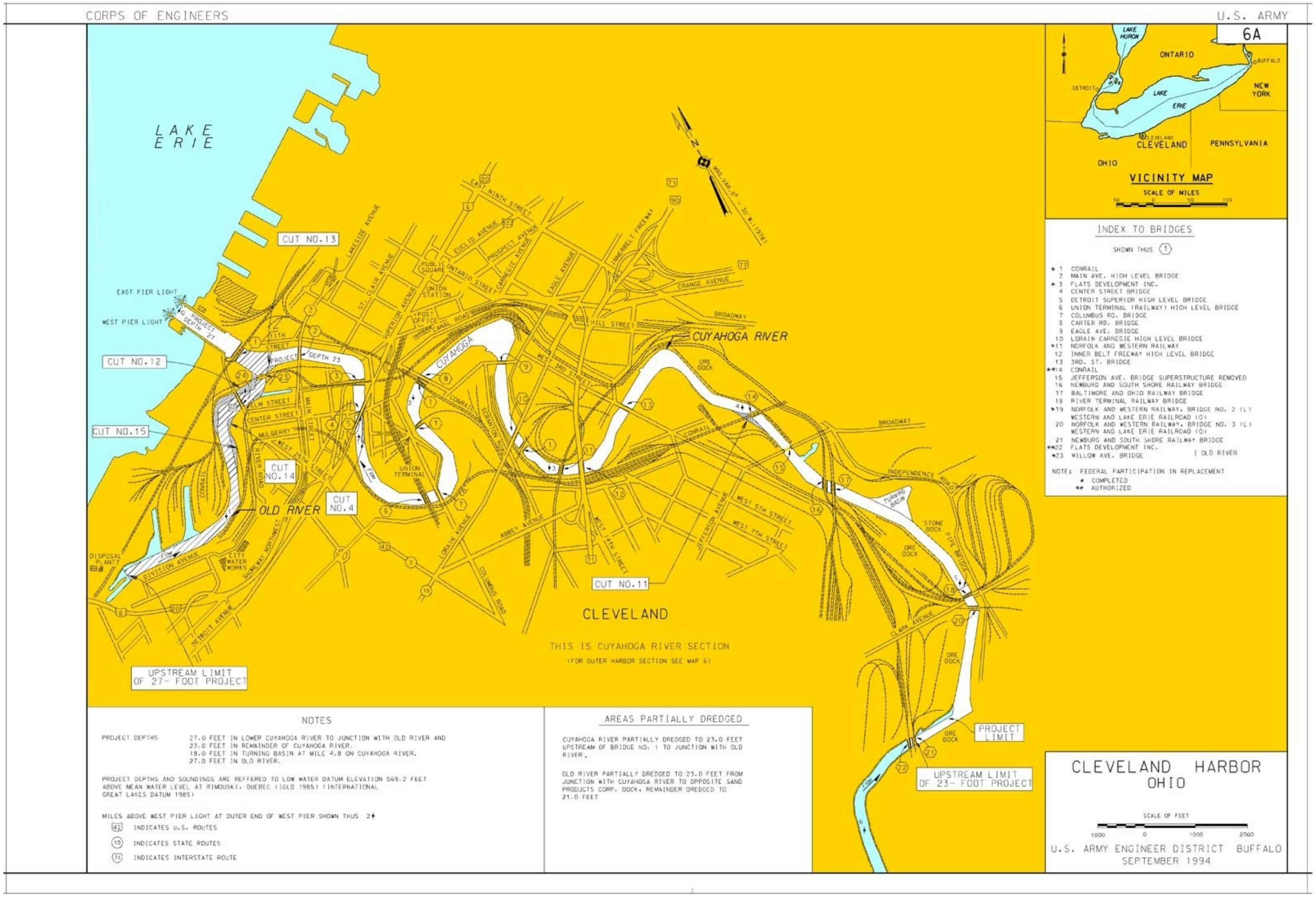


Figure 2. Cleveland Harbor, Project Limits



3. SPONSOR/STAKEHOLDER COORDINATION

Those interested in Cleveland Harbor include a myriad of public and private entities as well as the citizens of the Cleveland Metropolitan Area. The primary public entities are the Cleveland Port Authority and City of Cleveland who are likely to sponsor this effort. As the sponsor, they would be responsible for providing the non-federal funding, executing the Project Cooperation Agreement (PCA) and satisfying the sponsor's obligations outlined in the PCA. The Cuyahoga County Planning Commission is also highly interested in the results of this study along with several other Federal, State and local agencies/organizations involved in the development and regulation of Cleveland water resources. Shippers, private marina operators, environmental organizations, and the general public are the primary private entities interested in the Cleveland DMMP.

The goal of project coordination is to open and maintain channels of communication with interested parties. The objectives of project coordination are: 1) to provide information about proposed USACE activities; 2) to make interested parties' desires, needs, and concerns known to decision-makers; 3) to provide for consultation with interested parties before decisions are reached; and, 4) to consider the views of interested parties in reaching decisions. It should be noted, however, that the USACE cannot relinquish its legislated decision-making responsibility; the outcome of any planning study is subject to institutional constraints.

Project coordination activities will include newsletters, public workshops, and meetings with interested parties, pertinent agencies, and local officials. Coordination with the potential sponsor and stakeholders will begin at study initiation and will be maintained throughout the study process.

4. STUDY PROCESS

Dredged material management planning for all Federal harbor projects is conducted by the USACE to ensure that maintenance dredging activities are performed in an environmentally acceptable manner, use sound engineering techniques, are economically warranted, and that sufficient confined disposal facilities are available for at least the next twenty years. These plans address dredging needs, disposal capabilities, capacities of disposal areas, environmental compliance requirements, and potential for beneficial usage of dredged material and indicators of continued economic justification. The DMMP shall be updated periodically to identify any potential changed conditions. DMMPs are required under USACE Engineer Regulation, ER 1105-2-100, Planning Guidance Notebook, Chapter 3, Corps Civil Works Missions.

The DMMP will be prepared in accordance with the guidance contained in the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (1983) and ER 1105-2-100 (22 April 2000). As such, it will follow the six-step feasibility study planning process, which is:

- **Problem Identification**: Identify the water and related land resources problems and opportunities (relevant to the planning setting) associated with the Federal objective and specific State and local concerns.
- **Inventory and Forecast Conditions**: Identify, analyze, and forecast existing and future conditions without project water and related land resource conditions.
- **Preliminary Formulation and Screening of Alternatives**: Formulate alternative plans that address planning objectives.
- **Evaluation of Alternative Plans**: Evaluate alternative project plans for effectiveness, efficiency, completeness, and acceptability.
- **Compare Alternative Plans**: Compare plans by performing benefit-cost analysis to prioritize and rank alternatives.
- **Plan Selection**: Select a plan for recommendation after consideration of the various alternatives, their effects, and public comments.

5. STUDY PRODUCTS

The two major products that will be produced during the study will be:

5.1 Dredge Material Management Plan

The DMMP will document the study process, the coordination that occurred, and the technical analysis that resulted in the selected plan to address Cleveland Harbor's dredge disposal needs for at least the next twenty years. It will describe the problem, identification and formulation activities that were conducted, and the management alternatives that were considered. The DMMP will specifically document the following major activities along with any other supplementary studies that may be identified during the course of the study:

Engineering Studies: All engineering investigations that support the analysis of alternatives and provide the basis for the recommended plan will be documented. These will include surveying and mapping, hydrology and hydraulics studies, coastal/geotechnical investigations, cost estimating, etc.

Economic Studies: The economic investigations that will be documented will identify historical, existing, and future port conditions by looking at commerce moving via Cleveland Harbor and Cuyahoga River Channel; the types of vessels utilized; facilities that use the channel; and transportation costs as it relates to existing and future project conditions. Data will be collected, analyzed, and integrated from a variety of sources including the

Institute for Water Resources (IWR) and the Waterborne Commerce Statistics Center. The economic analysis that results in the determination of National Economic Development (NED) benefits including risk analysis attributable to the proposed project will also be included.

Environmental Studies: The environmental studies that are performed in accordance with the National Environmental Policy Act (NEPA) and applicable or relevant and appropriate regulations to identify specific measures necessary to manage the disposal of future maintenance dredged material and potential new material dredged from Cleveland Harbor will be contained in a NEPA document that will be prepared to accompany the DMMP. The study's NEPA document will identify and evaluate dredged material placement alternatives and mitigation measures if necessary. The NEPA documentation will address the following pertinent issues: environmental and cultural resources data, environmental impacts, mitigation plans, and environmental compliance. Additionally, the potential effects on the human and natural environment will also be determined. To identify and evaluate dredged material placement alternatives and mitigation efforts, the USACE will request that the U.S. Fish and Wildlife Service (USFWS), the U.S. Environmental Protection Agency (USEPA), and others actively participate in study workgroups and public meetings.

The NEPA documentation will be prepared in accordance with the President's Council on Environmental Quality Rules and Regulations. Documentation will be prepared as defined and amended in 40 Code of Federal Regulations (CFR) Parts 1500-1508.

- **Preliminary Project Cooperation Agreement (PCA) and Financing Plan:** As the recommended plan is finalized, the USACE and the non-Federal sponsor will begin reviewing HQUSACE-established model language for the PCA of a dredged material management project, making necessary revisions as they pertain to the proposed project. The non-Federal sponsor will prepare a letter of intent that acknowledges the requirements of local cooperation and expresses good faith intent to provide required items of local cooperation for the recommended project. Additionally, the non-Federal sponsor will develop a preliminary financing plan describing its plans for financing the local share of the cost of the project. The Buffalo District will prepare an assessment of the non-Federal sponsor's capability to implement the financing plan. Coordination of the draft PCA and preliminary financing plan will be completed concurrent with the draft DMMP. The preconstruction planning and design costs will be subject to cost sharing as part of the first year of construction costs under the terms of the PCA.

6. STUDY TASKS

The first task will be a literature search to identify completed DMMPs and innovative technologies or methodologies that may be applicable to Cleveland Harbor. The remaining tasks will follow the six step planning process, mentioned above. When appropriate, the specific engineering, economic and environmental study tasks will be broken out.

6.1 Problem Identification

Study area water resources-related problems and opportunities will be defined in terms of the Federal objective and specific study planning objectives. Problems and opportunities will encompass current as well as future conditions and will reflect the priorities and preferences of the Federal Government, the non-Federal sponsor and other groups participating in the study process. This problem identification step or 'scoping' will begin at study initiation.

NEPA regulations CFR, Parts 1500-1508, require all Federal agencies that conduct water resource-related planning studies to conduct a scoping process. The NEPA scoping process determines the scope of issues to be addressed and identifies the significant issues related to a proposed action. Although NEPA scoping has traditionally been associated with identifying the environmental concerns associated with proposed actions, it can be combined with the plan formulation scoping process (specifying problems and opportunities) identified in this section. Therefore, to thoroughly define the project and minimize any duplication of efforts, these activities will be conducted simultaneously using stakeholder meetings, correspondence, fact sheets, etc.

Once problems and opportunities are properly defined, study planning objectives and constraints will be determined. Planning objectives are statements that describe the desired results of the planning process. Planning objectives will be directly related to the problems and opportunities identified for the study and will be used for the formulation and evaluation of plans. Constraints are restrictions that limit the planning process. This study will consider resource, legal, and policy constraints. Resource constraints are those associated with limits on knowledge, expertise, experience, ability, data, information, money, and time. Legal and policy constraints are those defined by law, USACE policy, and guidance. Alternative plans will be formulated to meet study objectives and to avoid violating constraints.

These tasks will be undertaken with the basic understanding that the problem at Cleveland is that the CDF is reaching capacity. Without a new disposal site or the identification of other means of extending the life of the CDF, the impact on the local and regional economy will be significant. Many industries depend on the harbor for the receipt of materials to support their operations.

6.2 Inventory and Forecast Conditions

The second step of the planning process is to develop an inventory and forecast of critical resources (e.g., physical, demographic, economic, social, etc.) relevant to the problems and opportunities under consideration in the planning area. This information will be used to further define and characterize the identified problems and opportunities. A quantitative and qualitative description of these resources will be made for both current and future conditions and will be used to define existing and future without-project conditions. Existing conditions are those at the time the study is conducted. The forecast of the future without project condition reflects the conditions expected during the twenty-year project life. The future without project condition provides the basis from which alternative plans are formulated and impacts are assessed. Since impact assessment is the basis for plan evaluation, comparison and selection, clear definition and full documentation of the without-project condition are essential. Forecasts will be made for selected years over the twenty-year period of analysis to indicate how changes in economic and other conditions are likely to have an impact on problems and opportunities. The various study tasks that will be conducted during this phase of the planning process are identified below.

Engineering Tasks

6.2.1 Surveys and Mapping

Aerial Photography

Existing files will be researched for information that might be available. New aerial photography will be acquired as necessary during the three year DMMP study.

Topographic Surveys

Topographic data may be required to establish the limits of a potential upland disposal site, as well as the boundaries of locations on or near shore. The necessity of these surveys will be determined during the study.

6.2.2 Civil Structural Studies - Inventory Existing Conditions

This task includes gathering, inventorying, and reviewing various data, including historical surveys, previous USACE reports, existing physical conditions, etc. that could potentially impact recommended alternatives.

6.2.3 Civil Structural/General Design Studies - Inventory Existing Conditions

This task includes gathering, inventorying and reviewing various data, including: historical surveys; previous USACE reports; existing physical conditions such as soil characteristics, waves, winds, etc. and all pipeline and cable permits which could potentially impact recommended alternatives. This review will determine any data gaps where additional information will be required and identify any additional investigations that will be conducted.

Economic Tasks

6.2.4 Types and Volumes of Commodity Flow

An analysis of existing, as well as potential, commodity flows into and out of the study area will be conducted over the twenty-year project life. This analysis will result in a determination of the following:

- Origins and destinations of import, export, commodity shipments;
- Commodity trade routes;
- The transportation mode or modes by which commodities are carried to or from the port;
- The sizes and types of vessels used for transportation; and
- A description of the economic study area in terms of:
  - Commodities, current and prospective;
  - Existing port development, including port infrastructure;
  - Local municipalities;
  - The local economy; and
  - Competing ports.

Data sources will include Waterborne Commerce of the United States and interviews with harbor and facility representatives as well as any other relevant publications or knowledgeable industry personnel.

6.2.5 Project Waterborne Commerce

Commerce projections that reflect the potential use of the waterway over the twenty-year project life will be developed. The volume of harbor commerce will be projected on a commodity-by-commodity and trade route-by-trade route basis. Commerce projections will be based upon, but not limited to, any or a combination of the following methods: relating the traffic base to an index over time (e.g., general indices on an industry basis); independent hinterland and resource availability studies supplemented by interviews of relevant shippers, carriers, port officials, commodity consultants and experts; and/or statistical analysis of historical flow patterns.

6.2.6 Vessel Fleet Composition and Cost

Vessel Fleet Composition

Historical, present and future vessel/fleet size and composition will be established, comparison of which will result in determination of anticipated fleet changes over the period of analysis. Fleet composition will be considered according to trade route, type of commodity, and volume of traffic, capacity utilization, and any port or canal restrictions.

Vessel Operating Costs
Waterborne commerce transportation costs will be based on vessel operating costs obtained from discussions with Great Lakes' fleet operators.

6.2.7 Current Cost of Commodity Movement

The total origin-to-destination transportation costs for commodity movement will be estimated for the without and with project conditions. Estimated costs will include necessary handling, transfer, and storage, as well as any other accessory charges.

6.2.8 Current Cost of Alternative Movement

The economic concept of substitution applies to production as well as to consumption. The essence of this task is to identify and evaluate substitutes for this project. Such options may include alternative harbors, traffic management, or use of other modes of transportation. Information will be obtained through a search of appropriate literature and interviews with harbor users.

6.2.9 Future Cost of Commodity Movements

This task will result in an estimate of the relevant shipping costs during the period of analysis and future changes in fleet composition, port delays, and port capacity.

6.2.10 Use of Harbor With and Without a Project

The purpose of this task is to estimate harbor use over time, both without and with the project. Applicable data obtained for the establishment of existing conditions will be used as the foundation for this analysis. Data requirements include determination of the use of the harbor in terms of fleet composition, commodity flows, and transportation costs for without and with project conditions.

6.2.11 National Economic Development Benefits

NED benefits will be developed for with- and without-project alternatives.

<u>Environmental Tasks</u>

6.2.12 Sediment Quality Data

Available sediment quality data will be evaluated to determine the suitability of the sediments dredged from the Federal harbor for unconfined open-lake discharge as well as their suitability for beneficial use. Trends in sediment contamination levels at Cleveland Harbor will be assessed to forecast future management needs.

6.2.13 Historical Data – Fish and Wildlife Resources

Existing information from previous Cleveland Harbor studies will be researched for historical data concerning benthic, wetlands, and fishery communities within the study area.

6.2.14 Wetland Trend Analysis

Wetland trends within the study area will be analyzed. Wetlands within the project area will be identified and delineated in accordance with the Corps of Engineers Wetland Delineation Manual (January 1987).

6.2.15 Cultural Resources

In accordance with Section 106 of the National Historic Preservation Act, consultation will be initiated with the National Park Service, Ohio State Historic Preservation Office (SHPO), Indian tribes, and local historic preservation organizations to identify known archaeological sites and historic properties within the area(s) of potential effect (APE). An evaluation of the nature and extent of the proposed project and degree of ground disturbance resulting from the previous and current use of the APE will be used to determine the need for and scale of Phase I and Phase II cultural resource surveys. The significance of any sites/properties identified during this process will be evaluated to determine their eligibility for listing in the National Register of Historic Places. As needed, adverse effects on these properties would be resolved through continued consultation with the SHPO and other consulting parties.

6.2.16 Socioeconomic Data

Current demographic data will be reviewed to identify minority and low-income communities in the vicinity of potential disposal/beneficial use sites in order to ensure their involvement in the project's public participation program; achieve the goal of environmental justice; and avoid, minimize and/or mitigate any disproportionate adverse environmental effects on these communities.

6.3 PRELIMINARY FORMULATION AND SCREENING OF ALTERNATIVES

In the third step in the planning process, non-structural and structural management measures to include beneficial reuse will be identified that meet one or more planning objectives. A range of alternative plans based on (combinations of) screened management measures will be identified in partnership with the potential sponsor and stakeholders. These will be refined and scaled in subsequent iterations throughout the planning process. It should be noted that additional alternative plans (new plans) could be included for evaluation at any time during the process.

Some of the potential measures for the Cleveland DMMP and the preliminary screening criteria are listed in the Preliminary Screening of Measures Table on the next two pages.

PRELIMINARY SCREENING OF MEASURES

Category	Measure	General Performance	General Engineering Feasibility	Relative Cost	Relative Environmental Impacts	Relative Socio-Economic Impacts	Potential for Combining with Other Measures	Status
No-Action	No-action							
Confined Disposal Facilities	Vertical Expansion of Existing CDF							
	CDF Management (Dewatering)							
	Recycling CDF						Can be combined with other measures.	Retain alt. Combine with…
	Nearshore Disposal							
	Construct New CDF							
	Open Lake Disposal							
Beneficial Uses	Manufactured Soils							
	Environmental Restoration & Protection							
	Shallow Water Habitat							
	Recreational							

Category	Measure	General Performance	General Engineering Feasibility	Relative Cost	Relative Environmental Impacts	Relative Socio-Economic Impacts	Potential for Combining with Other Measures	Status
	Hill/Industrial Buffer							
Contaminant Reduction	Nutrient Management							
	Animal Waste Management							
	Pest Management							
Sediment Load Reduction	Crop Residue Management							
	Conservation Cropping Sequence							
	Alternative Crops							
	Grassed Waterways							
	Wetland Sediment Ponds							
	Agricultural Runoff Retention Reservoirs							
	Filter Strips							

Category	Measure	General Performance	General Engineering Feasibility	Relative Cost	Relative Environmental Impacts	Relative Socio-Economic Impacts	Potential for Combining with Other Measures	Status
Sediment Reduction Load Cont.	Stream Bank Erosion							
	Developing Market for Canola Crop							
	Sediment Reduction Strips							

Formulated plans will be in compliance with existing statutes, administrative regulations, and common law or include proposals for changes, as appropriate. Section 904 of WRDA 1986 requires the USACE to address the following matters in the formulation and evaluation of alternative plans:

- Enhancing National Economic Development;
- Protecting and restoring the quality of the total environment;
- The well-being of the people of the United States;
- The prevention of loss of life; and
- The preservation of cultural and historical values.

Engineering Tasks

6.3.1 Technical Coordination for Evaluation of Alternative Plans

The design of dredged material disposal alternatives will include the development of preliminary costs and plans for each management alternative.

6.3.2 Limited Field Data Collection

Limited field studies are intended to provide basic information required for the initial assessment. If initial evaluations determine that an alternative warrants further evaluation, more extensive data collection efforts may be required which may result in the development of scopes of work for additional studies needed for alternative evaluation and selection.

Environmental Tasks

6.3.3 Environmental Resource Inventory

An Environmental Resource Inventory will be prepared from a review of relevant literature. This report will document existing environmental resources occurring in or surrounding the study area. The supplemental environmental inventory will include information regarding the navigation project, recreational and natural resources impacts, aerial data, historical data, GIS capabilities, and the selection of the recommended plan. Tasks will include coordination in accordance with the Endangered Species Act, Fish and Wildlife Coordination Act, and Costal Zone Management Act.

6.3.4 Determine Sediment Suitability:

The suitability of dredged sediments for placement in the selected alternative disposal site(s) will be analyzed. The compatibility of the dredged material to sediments present within the discharge site will be addressed. If applicable, the detrimental effects of contaminants in the dredged material will also be addressed. This analysis will also be utilized in preparing the 404(b)(1) Evaluation.

Interdisciplinary Study Team Tasks

6.3.5 Development of Weighting Factors

If appropriate, weighting factors will be developed to assist in the evaluation of alternative plans. Both the USACE study team and appropriate stakeholders will participate in their identification.

6.3.6 Locate Suitable Beneficial Use/Disposal Sites

Beneficial uses of dredged material, in combination with other project measures, will be investigated for the placement of material dredged from Cleveland Harbor. Beneficial use disposal sites will be identified through the efforts of the USACE study team in association with appropriate stakeholders and various Federal and State agencies. All potential measures will be identified and analyzed for potential placement suitability.

6.3.7 Independent Technical Review - In-Progress Review

The dredged material management study's review process is intended to identify and resolve concerns that might otherwise delay or preclude HQUSACE approval of the draft report. In-progress reviews can be held at any point in time during the study process to provide an update of study findings and progress, identify potential problems (technical/policy), and document decisions. Early identification and resolution of technical/policy concerns at, or subsequent to the in-progress review, will allow the Buffalo District to make necessary project adjustments prior to submitting a draft report.

The entire study team and the non-Federal sponsor will participate in the in-progress review. This meeting will be a key decision point in determining whether alternatives meet Federal and non-Federal policies and budgetary criteria and should be recommended for project implementation.

This study task includes the Project Delivery Team (PDT) internal review to include functional chiefs and an Independent Technical Review (ITR). The ITR will be performed by persons not involved in the development of the DMMP and led by a Regional Technical Specialist outside the District.

Real Estate Tasks

6.3.8 Real Estate and Alternative Plans

Real Estate will provide advice and monitor real estate activities and issues for various alternative plans. Real estate studies, at this point, will be preliminary in nature and identify issues and provide information to be considered in determining the selection of the recommended plan.

6.4 EVALUATION OF ALTERNATIVE PLANS

The fourth step in the planning process is the evaluation of alternative plans. The evaluation of project effects is a comparison of the with-project and without-project conditions for each alternative.

Evaluation consists of four general tasks:
The first task is to forecast the most likely with-project condition expected under each alternative plan. Each with-project condition will describe the same critical variables included in the without-project condition. Criteria to evaluate the alternative plans include all significant resources, outputs and plan effects. They also include contributions to the Federal objective, the study planning objectives, compliance with environmental protection requirements, the four evaluation criteria (completeness, effectiveness, efficiency and acceptability) and other criteria deemed significant by participating stakeholders. The definitions of completeness, effectiveness, efficiency and acceptability are:

Completeness is a determination of whether or not the plan includes all elements necessary to achieve the objectives of the plan. It is an indication of the degree that the outputs of the plan are dependent upon the actions of others.

Effectiveness is defined as a measure of the extent to which a plan achieves its objectives. All of the plans in the final array provide some contribution to the planning objectives.

Efficiency is a measure of the cost effectiveness of the plan expressed in net benefits. All of the plans in the final array provide net benefits.

Acceptability is defined as acceptance of the plan to the local sponsor and the concerned public. All of the plans in the final array must be in accordance with Federal law and policy. *The plans are either more or less acceptable than other plans. Since all plans meet Federal criteria, they are considered minimally acceptable (plans that do not meet this criteria should have been screened at the preliminary plan stage.)*

The second task is to compare each with-project condition to the without-project condition and document the differences between the two. The third task is to characterize the beneficial and adverse effects by magnitude, location, timing and duration. The fourth task is to identify the plan(s) that will be further considered in the planning process, based on a comparison of the adverse and beneficial effects and the evaluation criteria.

Engineering Tasks

6.4.1 Coastal/Geotechnical Evaluation

Information obtained previously in the study effort task will be reviewed to provide an initial coastal/geotechnical assessment of the suitability of foundation conditions for alternative plans. This assessment will coincide with the *Compare Alternative Plans* task in order to coordinate ranking of plans based on engineering feasibility and environmental suitability. The *Project Cost Estimates* task will then begin, and include only those alternatives that best meet these criteria.

6.4.2 Rough Order of Magnitude (ROM) Estimates

Initial construction cost estimates will be prepared for each dredged material management alternative. Alternative estimates will be reviewed for appropriate equipment, productivity, and operational factors. For non-dredging work, ROM estimates will be prepared using spreadsheets. These spreadsheet estimates will be based on the escalated historical cost of similar projects.

Economic Tasks

6.4.3 Average Annual Costs

Average annual equivalent construction costs, including interest during construction and operation and maintenance costs will be calculated for project level cost estimates of each project alternative. The discount rate used for this analysis will be the discount rate established annually for the formulation and evaluation of plans for water and related land resources.

Environmental Tasks

6.4.4 Socioeconomic Analysis

Non-monetary social and economic impacts will be evaluated on the region, community, and groups within the zone of influence of the project. Impacts to be considered under the other social effects account will include the following: income distribution; employment distribution; population distribution and composition; the fiscal condition of the state and local governments; the quality of community life; life, health, and safety factors; displacement; and long-term productivity. Impacts to minorities and low-income groups will also be evaluated and incorporated into the environmental justice analysis in the NEPA document.

6.4.5 Mitigation Analysis Report

A detailed evaluation addressing possible actions that would offset any unavoidable impacts associated with the study's alternatives will be conducted. All efforts will be made to reduce any potential environmental impacts associated with the proposed DMMP; however, if adverse environmental impacts are unavoidable, then a mitigation plan will be developed.

6.4.6 Evaluate Proposed Alternatives

During this study task, proposed alternatives that were derived during the modeling studies and stakeholder meetings will be evaluated to determine environmental benefits that could possibly occur by implementing each proposed alternative. The no action alternative will be included as part of this assessment. Each alternative will be evaluated from an environmental perspective for impacts that may occur to air and water quality, vegetation, fish and wildlife habitat, etc. Environmental and socioeconomic impacts will be assessed for each proposed alternative.

6.5 COMPARE ALTERNATIVE PLANS

In the fifth step of the planning process alternatives (including the no action plan) are compared against each other, with emphasis on the outputs and effects that will have the most influence in the decision making process. Beneficial and adverse effects of each plan will be compared; these effects include both monetary and non-monetary benefits and costs. Identification of tradeoffs will also be documented to support the team's final recommendation. This comparison step is a reiteration of the evaluation step; with the exception that in this step each plan (including the no action plan) is compared against each other and not against the without-project condition. The output of the comparison step will be a ranking of plans.

Trade-off Analysis

The first trade-offs to be considered in evaluating the final alternative plans is to distinguish between the No Action Alternative and the other action alternatives. This is followed by the trade-off between the action alternatives.

(1) Action versus No Action

The no action alternative ranks lower than the action alternatives in that it is not effective in meeting any of the planning objectives. It has no positive benefits or impacts, since it is the basis from which the impacts and benefits are measured. It does not, however, involve incurring the implementation cost or adverse impacts of the action alternatives.

(2) Trade-Offs between Action Alternatives

The second level of trade-offs to consider is those between the action alternatives. Of the action alternatives considered, there is an obvious trade-off between ***describe trade-offs***.

Compare responses to the formulation criteria – efficiency versus effectiveness, efficiency versus acceptability.

ALTERNATIVE COMPARISON

ALTERNATIVE	COMPLETENESS	EFFECTIVENESS	EFFICIENCY	ACCEPTABILITY
NO ACTION				
ALT. 1				
ALT. 2				
ETC.				

6.6 PLAN SELECTION

In the sixth and final step in the planning process a single alternative plan will be selected. The recommended plan will be shown to be preferable to taking no action or implementing any of the other alternatives considered during the planning process.

PLAN SELECTION

The following designations will be made in the selection process:

a. National Economic Development (NED) Plan. This is the plan that maximizes net national economic benefits.

b. National Ecosystem Restoration (NER) Plan. This is the plan that reasonably maximizes net ecosystem restoration benefits by having the maximum excess of beneficial ecosystem effects for the costs.

c. Optimum Trade-off Plan. This is the plan that provides the best mix of contributions to net national economic development and ecosystem restoration. It attempts to maximize the sum net of net economic and ecosystem effects.

d. Locally Preferred Plan. This is the plan that, in the opinion of the sponsor, best meets the needs of the local community.

e. Selected Plan.

Engineering Tasks

6.6.1 Project Cost Estimates

Project cost estimates will be developed for the recommended plan through the plans and specifications study phase.

6.6.2 Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) Cost Estimates

OMRR&R estimates will be prepared in support of the recommended plan.

6.6.3 Non-Federal Estimates

Non-Federal dredged material cost estimates will be developed for the recommended plan through the plans and specifications study phase.

6.6.4 Baseline Fully Funded Cost Estimate

As part of this study task, a Construction Execution Plan will be developed; consideration will be given to the size of the construction contract, phasing within each contract, and the sequencing of contracts. A Microcomputer Aided Cost Engineering System fully funded cost estimate will be prepared taking into consideration the Construction Execution Plan.

<u>Environmental Tasks</u>

6.6.5 NEPA Document

A NEPA document will be prepared to evaluate the environmental impacts associated with the management of material dredged from Cleveland Harbor. Information from fish and wildlife, cultural resources, and other resource-specific studies will be incorporated into the NEPA document.

6.6.6 Cultural Resources

As appropriate, Phase I and Phase II Cultural Resource Surveys will be completed.

6.6.7 Section 404(b)(1) Evaluation

In compliance with the Clean Water Act, a 404(b)(1) Evaluation will be prepared to analyze any potential water quality impacts associated with the placement of fill materials dredged from the study area and discharged into the waters of the United States.

6.6.8 Section 7, Endangered Species Act

The USFWS and ODNR will be requested to furnish information as to whether any listed threatened or endangered species or designed critical habitat, are within the proposed project area. If so, the USACE will prepare a Biological Assessment (BA) to determine if the proposed project may effect the study area, a BA will not likely be required.

6.6.9 Section 401 State Water Quality Certification (WQC)

Where applicable, WQC will be obtained from the State of Ohio stating that the proposed management alternative would not be in violation of the State's water quality standards.

6.6.10 Ohio Coastal Zone Management Program Federal Consistency Determination:

An Ohio Coastal Zone Management Program Federal Consistency Determination will be prepared to document compliance with the management policies of the program.

6.6.11 All Other Environmental Documents

This study task includes determination of compliance with other applicable environmental laws and regulations not specifically mentioned above [e.g., Air Conformity Determination (Clean Air Act) and compliance with appropriate Executive Orders].

6.6.12 Record of Decision

If applicable, upon completion of the NEPA document, a comprehensive summary will be prepared to report compliance with all environmental requirements.

Real Estate Tasks

Real Estate will advise and monitor real estate activities associated with the Recommended Plan by: providing a Real Estate Plan, preliminary attorney opinion(s) of compensability, and fair market appraisals; attending and participating in real estate public meetings and hearings, contributing to real estate drawings, providing detailed acquisition information to assure acquisitions are conducted in compliance with Federal Law, and attending project team meetings; and providing input into and reviewing the draft and final report and participating in the ITR.

7. SUMMARY

The DMMP will document the study analyses, conclusions, and recommendations. It will be the result of an iterative process that will include draft versions of the document and ITR

The DMMP will be prepared in accordance with guidance contained in ER 1105-2-100 and it will consist of:

- A main report summarizing the study's technical findings, conclusions and recommendations;
- Technical appendices, as necessary, presenting the detailed evaluations and results of individual work tasks; and
- Draft NEPA document(s).

APPENDIX D

NEPA COORDINATION

U.S. Army Corps of Engineers
Buffalo District

ENVIRONMENTAL IMPACT STATEMENT
CLEVELAND HARBOR, CUYAHOGA COUNTY, OHIO
DREDGED MATERIAL MANAGEMENT PLAN

PUBLIC SCOPING INFORMATION PACKET

March 16, 2006

ANNOUNCEMENT OF PUBLIC SCOPING MEETINGS

The U.S. Army Corps of Engineers (USACE), Buffalo District, is proposing to identify problems and opportunities associated with the management of dredged material at Cleveland Harbor and identify significant issues that we should address during the Dredged Material Management Plan (DMMP) development process. The USACE is the Federal lead agency directing preparation of the Environmental Impact Statement (EIS) for the proposed DMMP. The EIS will be prepared in accordance with the requirements of the federal National Environmental Policy Act (NEPA) of 1969 and its implementing regulations, and associated rules and regulations of the Council on Environmental Quality (CEQ). The EIS is also expected to satisfy the environmental review requirements of the State of Ohio.

The Buffalo District will conduct a public scoping meeting in Cleveland, Ohio, to solicit public comment and input on issues related to the proposed DMMP that will be addressed in the EIS, and on the studies that are proposed to be conducted for the EIS. The date of the public meeting has not been arranged yet, however, the meeting is anticipated to be held in the summer of 2006.

Table of Contents

Figures & Tables:

1.0 INTRODUCTION

The U.S. Army Corps of Engineers (USACE) is preparing an Environmental Impact Statement (EIS) for the proposed **Cleveland Harbor Dredged Material Management Plan (DMMP)** (the action) and other alternatives to develop a long-term (20-year) strategy for providing viable dredged material placement alternatives that would meet the needs of maintaining the Federal channels at Cleveland Harbor.

Cleveland Harbor is located on Lake Erie at the mouth of the Cuyahoga River. The harbor is 191 miles southwest of Buffalo, NY and 110 miles east of Toledo, Ohio (Figure 1). Included in the study area are the Outer Harbor and Cuyahoga River Channels. The harbor measures about 1,300 acres, is 5 miles long and varies in width between 1,600 to 2,400 feet. The harbor is protected by a breakwater system: an east breakwater (20,970 feet long), a west breakwater (6,048 feet long), and the east and west arrowhead breakwaters (each measuring 1,250 feet). Authorized depths in this area range from 25 to 28 feet. The East and West Arrowhead Breakwater protect the Lake Approach Channel with an authorized depth of 29 feet. The Entrance Channel varies in width from 750 to 220 feet and is maintained at an authorized depth of 28 feet to the mouth of the Cuyahoga River. The lower Cuyahoga River Channel, from the lakeward side of the piers to immediately above the Old River confluence, is maintained to an authorized depth of 27 feet. The upper Cuyahoga River and turning basin are maintained to an authorized depth of 23 feet and 18 feet respectively.

Cleveland Harbor is dredged twice each year. The average dredging volume per year from 1998 through 2005 is 305,000 cubic yards; this includes Federal and non-Federal dredging activities.

Since the 1960's, five Confined Disposal Facilities (CDFs) have been constructed at Cleveland Harbor (9, 10B, 12, 13, and 14). The current operational CDF 10B is nearing design capacity. In accordance with joint U.S. Environmental Protection Agency (USEPA)/USACE protocols contained in the Great Lakes Dredged Material Testing and Evaluation Manual (1998), all sediment dredged from Cleveland Harbor and Cuyahoga River Channels is unsuitable for open lake and nearshore placement. All dredge material is currently disposed in a CDF.

In 1993, the Corps of Engineers initiated a program for the development of long-term plans for managing channel maintenance projects. Districts were directed to establish a Dredged Material Management Plan (DMMP) process for all deep-draft navigation projects. The Buffalo District initiated the DMMP in 2003 after identifying a lack of capacity in CDF 10B. For the Corps to pursue the DMMP in Cleveland, it was necessary for the Cleveland-Cuyahoga Port Authority and the City of Cleveland to send the Corps a letter of intent expressing interest in obtaining the Corps assistance in the planning and approval of a DMMP for Cleveland Harbor. This letter was sent on March 31, 2004. Accordingly, the USACE assumed the role of the Federal lead agency for preparation and issuance of an Environmental Impact Statement (EIS) for the proposed project, in accordance with the requirements of the National Environmental Policy Act (NEPA) of 1969.

The EIS will evaluate the social, economic, and environmental impacts that would result with the proposed action taken to address the purpose and need for the DMMP.

This public scoping information packet has been prepared as part of the formal scoping process for the Draft EIS (DEIS), pursuant to NEPA and the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 CFR Part 1500 et seq.). The purpose of the EIS scoping process is to provide opportunity for the public and agencies to comment on and provide input to the plan of study for the development of the DEIS.

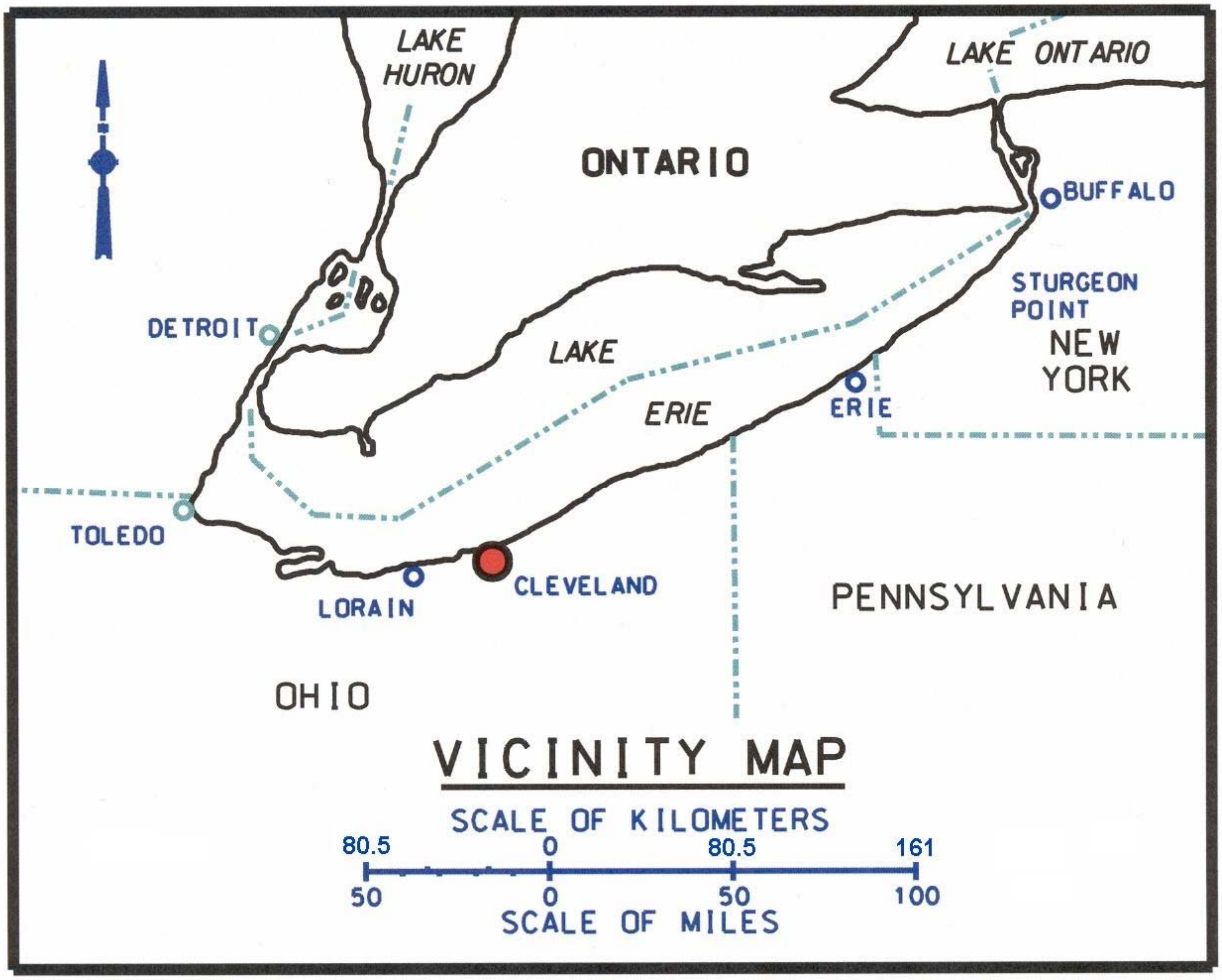


Figure 1 – Cleveland Harbor Vicinity Map

This packet provides information describing the EIS process for the proposed Cleveland DMMP, as follows:

- **Overview**: a description of the EIS process;
- **Purpose and Need for the Proposed Cleveland DMMP**;
- **Alternatives**: types to be evaluated in the EIS;
- **Social, Economic, and Environmental Impacts**;
- **Public Participation and Interagency Coordination Program**

2.0 STUDY OVERVIEW

2.1 Initiating the Process

Figure 2 shows the general steps in the EIS process. The process officially began when the Corps of Engineers initiated a program for the development of long-term plans for managing channel maintenance projects. Districts were directed to establish a Dredged Material Management Plan (DMMP) process for all deep-draft navigation projects. The Buffalo District initiated the DMMP in 2003 after identifying a lack of capacity in CDF 10B. With this information, and the City of Cleveland and Port Authority's letter to the USACE, expressing interest in obtaining the Corps assistance in the planning and approval of a DMMP for Cleveland Harbor, Buffalo District assumed the role of Federal lead agency for preparation of the EIS and is in the process of publishing a Notice of Intent (NOI) to prepare a DEIS in the Federal Register.

2.2 EIS Scoping Process

The purpose of the EIS scoping process is to provide an opportunity for the public and government agencies to comment on and provide input to help identify issues related to the proposed Cleveland DMMP to be addressed in the DEIS, and the studies that should be conducted for the DEIS. The Corps will be holding a public meeting in Cleveland, Ohio to provide information about the issues and studies for the DEIS, and to receive public and agency comments and suggestions for consideration in the DEIS.

Comments and input about the issues and studies for the DEIS will be accepted 30 days from the date of this packet and should be sent to:

Address:
U.S. Army Corps of Engineers
Buffalo District
ATTN: Patti McKenna
1776 Niagara Street
Buffalo, NY 14207-3199

Point of Contact:
Patti M. McKenna
Environmental Scientist
Environmental Analysis Section

Telephone: 716-879-4367
Fax: 716-879-4310
E-mail: patrice.m.mckenna@usace.army.mil

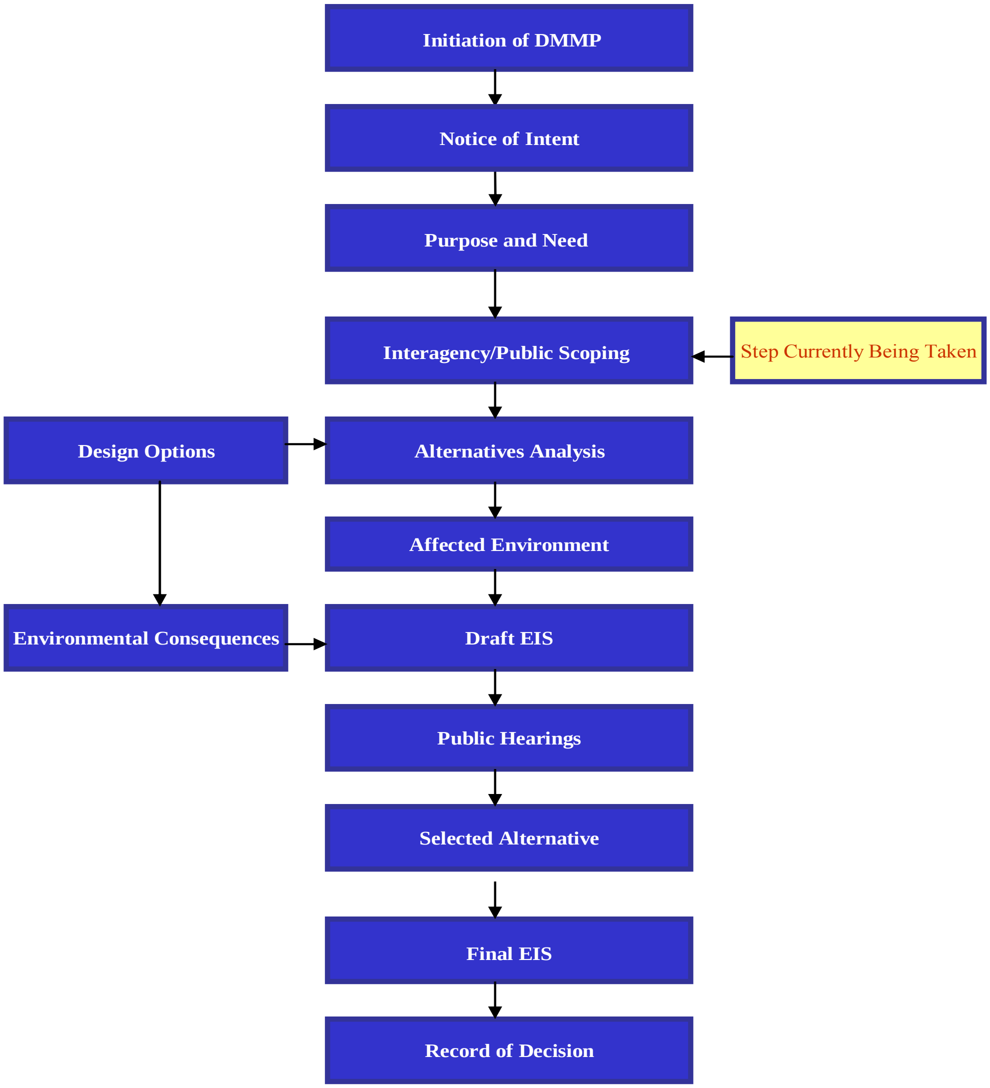


Figure 2 – Cleveland Harbor DMMP Project Development Process

2.3 DEIS Preparation

The DEIS will be prepared in accordance with NEPA regulations designed to identify significant environmental issues at an early stage and promote cooperative consultation among agencies before the DEIS is prepared. The DEIS will specifically follow the CEQ regulations implementing NEPA (40 CFR Part 1500 et seq.)

After its publication, the DEIS will be available for public and agency review and comment for a minimum 45-day period. A public hearing will be held to receive comments from the public and agencies on the document. Comments may also be provided orally at the hearing or in writing during the DEIS comment period.

3.0 PURPOSE AND NEED FOR THE PROPOSED DMMP

3.1 Overview

The purpose and need for the proposed project is to identify problems and opportunities associated with the management of dredged material at Cleveland Harbor and identify significant issues that we should address during the DMMP development process and completion of our required NEPA analysis.

3.2 Background

The U.S. Army Corps of Engineers, Buffalo District, in coordination with the U.S. Environmental Protection Agency and Ohio EPA have determined that, with the exception of some sandy material which accumulates at the upstream limit of the Cuyahoga River channel that may be used as beach nourishment material depending upon most recent test results, sediments dredged from Federal navigation channels at Cleveland Harbor would not be placed in the open lake, but would be placed in Confined Disposal Facilities.

Five Confined Disposal Facilities have been constructed at Cleveland Harbor (9, 10B, 12, 13, and 14). Sites 13 and 9 were constructed in the 1960s as part of a Great Lakes pilot project to determine the effects on water quality. Virtually all of the material dredged between 1970 and 1974 was placed in two CDF disposal areas constructed in the late 1960s. Public Law 91-611 in 1970 authorized the construction of spoil disposal facilities for a period to not exceed 10 years. Two facilities were built: Sites 12 and 14.

CDF 14 is an 88-acre facility with an estimated capacity of 6,130,000 cubic yards. This site was turned over to the non-Federal Sponsor in 1999. The site at that time was 95% filled.

A new CDF (Site 10B) was completed in 1998 adjacent to the Burke Lakefront Airport. The CDF 10B footprint is 68 acres and cost $17,500,000 to build. The actual physical inside capacity of the facility covers 58 acres. The 58-acre site provides storage for 2,900,000 cubic yards of in-place sediment.

In recent years, all sediment dredged at Cleveland Harbor has been deposited in Site 10B. The major problem relating to dredging at the harbor is that CDF 10B, originally projected to reach capacity in 2013, is now expected to reach capacity in 2007. Increased quantities of Federal dredging, dredging by private entities, and other factors have reduced the lifespan of the CDF. Plans for the future management of dredged material are now underway.

3.3 Project Goals

In order to identify acceptable dredged material management options and determine the ability of the Federal government to continue to maintain the harbor, the following considerations are important:

- availability and capacity of suitable dredged material placement sites
- effectiveness of beneficial use alternatives for the dredged material
- economic viability of the harbor
- compliance with environmental laws and regulations

4.0 ALTERNATIVES

Alternatives that will be evaluated in detail in the DEIS will be selected through a screening evaluation of potentially reasonable and feasible alternatives. A preliminary list of alternatives and the criteria for evaluating them will be defined in relation to the purpose and need of the project. Comments and suggestions received during the scoping process will be considered in the formulation of the list of preliminary alternatives and the screening criteria. Public meetings will be held during the EIS process to present and discuss the alternatives screening process and its results and conclusions.

The alternatives will represent a range of potential solutions that may address the purpose and need and satisfy the project goals, as described below:

Measure A – No Action: Under this alternative, the Federal Government would do nothing to address the need for future placement of dredged material. Without dredging, the navigation channel would progressively shoal in and impede commercial navigation. Deep-draft commercial navigation would become economically nonviable and gradually cease.

Measure B – Beneficial Use: Beneficial use of dredged material includes recreation, agricultural, and habitat development, beach nourishment, and innovative engineering alternatives such as dredge soil. In order to successfully implement beneficial uses, the alternative must be technically and economically feasible, obtain public support, and address legal and regulatory issues.

Measure C – Open-Lake Placement: A designated open lake disposal site is located 9 miles east of the north breakwater. In accordance with joint U.S. Environmental Protection Agency (USEPA)/USACE protocols contained in the Great Lakes Dredged Material Testing and Evaluation Manual (1998), all sediment dredged from Cleveland Harbor and Cuyahoga River Channels is unsuitable for open lake placement.

Measure D – New Confined Disposal Facility (CDF): USACE, Buffalo District has identified eight locations for future CDF development (Figure 3); the proposed locations are categorized as Inner (south of the breakwater) and Outer Harbor (north of the breakwater) CDFs. The alternative sites were selected during Phase I of the DMMP. The sites were selected by the Sponsors, USACE, and other City and County entities to include areas that were commensurate with the City of Cleveland's 50 Year Waterfront Development Plan. If additional CDF sites are developed during the alternative assessment phase, they will be evaluated fully.

Measure E – Management of Existing Confined Disposal Facilities to Extend Their Useful Life: The USACE, Buffalo District has constructed a number of CDF's in the past that have been filled or are essentially filled. Various actions such as construction of internal dikes and elevation of existing CDF walls could extend the useful life of these existing CDF's.

Measure F – Best Management Practices: Best Management Practices (BMP's) in the Cuyahoga River Watershed will also be considered in this study. BMP's would be generally designed to reduce sediment loads to the watershed and eventually to the Federal channels requiring dredging. BMP's include but are not limited to such watershed actions as no till farming; proper zoning along streambanks (e.g. buffer strips); and upstream sediment traps.

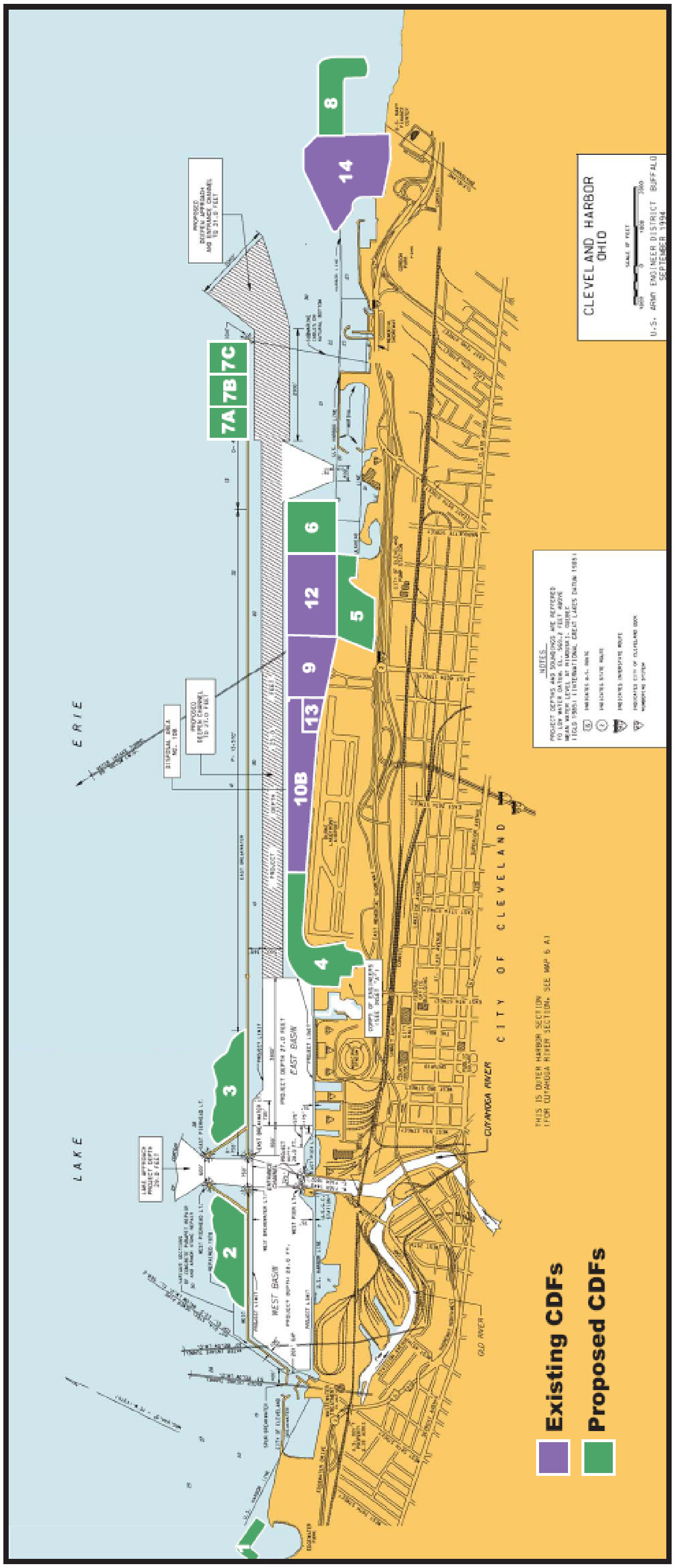
The identified alternatives will be screened against criteria to assess their fundamental feasibility and likely ability to satisfy the project purpose and need. Preliminary alternatives that are clearly infeasible or unreasonable, or do not have the potential to minimally satisfy most of the project objectives, will be eliminated from further study. The No-Action alternative will also be included in the detailed DEIS evaluations, serving to define the future baseline condition against which potential impacts of the DMMP alternatives will be compared.

5.0 SOCIAL, ECONOMIC AND ENVIRONMENTAL IMPACTS

Future conditions with the No-Action alternative and potential impacts with the proposed action and its alternatives will be assessed for the following social, economic, and environmental categories:

- Biological Resources
- Recreation
- Cultural Resources
- Socioeconomics
- Transportation
- Geology & Soils
- Water Resources
- Solid Waste Management
- Contaminated Materials
- Air Quality
- Noise
- Aesthetics
- Native American Tribes
- Environmental Justice

Figure 3 – Cleveland Harbor, Proposed CDF



6.0 PUBLIC PARTICIPATION AND INTERAGENCY COORDINATION PROGRAM

Throughout the scoping process, stakeholders and interested parties are invited to provide comment on the alternatives that will be evaluated in the DMMP/Environmental Impact Statement (EIS). The DMMP/EIS will address the potential social, economic and environmental benefits and adverse impacts that would result from each alternative plan selected for detailed analysis.

Compliance with Environmental Protection Statutes:

National Environmental Policy Act (NEPA). In accordance with the Council on Environmental Quality's "Regulations for Implementing the Procedural Provisions of the NEPA of 1969" (40 CFR 1500-1508) and Engineer Regulation 200-2-2 (Procedures for Implementing NEPA), the USACE, Buffalo District will assess the potential significant environmental impacts of the eventual recommended plan in an Environmental Impact Statement.

Clean Water Act. If a plan is proposed for implementation that involves the placement of dredged or fill material below the ordinary high-water mark of Lake Erie or any other waters of the United States, the project will be evaluated in accordance with the guidelines promulgated by the Administrator of the U.S. Environmental Protection Agency in conjunction with the Secretary of the Army under the authority of Section 404(b)(1) of the Act. A Section 404(a) Public Notice will be issued and any party that may be significantly impacted by the project will be afforded the opportunity to request a public hearing. Under Section 401 of the Act, USACE, Buffalo District will request certification from the OEPA that the proposed project is in compliance with established effluent limitations and water quality standards.

Under Section 402 of the Act, if a recommended DMMP measure disturbs greater than one acre of ground surface, USACE, Buffalo District would develop a Stormwater Pollution Prevention Plan for the construction activity and submit it along with a Notice of Intent application to OEPA for coverage under their general permit.

Coastal Zone Management Act. For those measures recommended under the preferred DMMP that are reasonably likely to affect any land or water use or natural resource of the State of Ohio's designated coastal zone, USACE, Buffalo District will assure that those activities or projects are consistent, to the maximum extent practicable, with the State's approved coastal management program. The USACE, Buffalo District will prepare a Federal Consistency Determination that will be coordinated with the Ohio Department of Natural Resources for their concurrence.

National Historic Preservation Act. Under Section 106 of this Act, this Scoping Information Packet also initiates consultation with the National Park Service, State Historic Preservation Office (Ohio Historical Society), potentially interested Indian tribes, historic preservation organizations and others likely to have knowledge of, or concern with, historic properties that may be present within the area of potential effect.

Other Coordination Requirements. In addition to the aforementioned Federal statutes, the proposed project must also comply with other applicable or relevant and appropriate Federal laws. Table 1 presents a comprehensive list of environmental protection statutes, executive orders, *etc.* Therefore, an additional intent of this fact sheet is to disseminate pertinent project information to meet the applicable coordination/consultation requirements required under their provisions.

Table 1. Federal Environmental Protection Laws, Orders, Policies.

1. PUBLIC LAWS

(a) American Folklife Preservation Act, P.L. 94-201; 20 U.S.C. 2101, *et seq.*
(b) Anadromous Fish Conservation Act, P.L. 89-304; 16 U.S.C. 757, *et seq.*
(c) Antiquities Act of 1906, P.L. 59-209; 16 U.S.C. 431, *et seq.*
(d) Archaeological and Historic Preservation Act, P.L. 93-291; 16 U.S.C. 469, *et seq.* (Also known as the Reservoir Salvage Act of 1960, as amended; P.L. 93-291, as amended; the Moss-Bennett Act; and the Preservation of Historic and Archaeological Data Act of 1974.)
(e) Bald Eagle Act; 16 U.S.C. 668.
(f) Clean Air Act, as amended; P.L. 91-604; 42 U.S.C. 1857h-7, *et seq.*
(g) Clean Water Act, P.L. 92-500; 33 U.S.C. 1251, *et seq.* (Also known as the Federal Water Pollution Control Act; and P.L. 92-500, as amended.)
(h) Coastal Barrier Resources Act of 1982, 16 U.S.C. § 3501 *et seq.*; 12 U.S.C. § 1441 *et seq.*
(i) Coastal Zone Management Act of 1972, as amended, P.L. 92-583; 16 U.S.C. 1451, *et seq.*
(j) Endangered Species Act of 1973, as amended, P.L. 93-205; 16 U.S.C. 1531, *et seq.*
(k) Estuary Protection Act, P.L. 90-454; 16 U.S.C. 1221, *et seq.*
(l) Federal Environmental Pesticide Control Act, P.L. 92-516; 7 U.S.C. 136.
(m) Federal Water Project Recreation Act, as amended, P.L. 89-72; 16 U.S.C. 460-1(12), *et seq.*
(n) Fish and Wildlife Coordination Act of 1958, as amended, P.L. 85-624; 16 U.S.C. 661, *et seq.*
(o) Historic Sites Act of 1935, as amended, P.L. 74-292; 16 U.S.C. 461, *et seq.*
(p) Land and Water Conservation Fund Act, P.L. 88-578; 16 U.S.C. 460/-460/-11, *et seq.*
(q) Migratory Bird Conservation Act of 1928; 16 U.S.C. 715.
(r) Migratory Bird Treaty Act of 1918; 16 U.S.C. 703, *et seq.*
(s) National Environmental Policy Act of 1969, as amended, P.L. 91-190; 42 U.S.C. 4321, *et seq.*
(t) National Historic Preservation Act of 1966, as amended, P.L. 89-655; 16 U.S.C. 470a, *et seq.*
(u) Native American Religious Freedom Act, P.L. 95-341; 42 U.S.C. 1996, *et seq.*
(v) Resource Conservation and Recovery Act of 1976, P.L. 94-580; 7 U.S.C. 1010, *et seq.*
(w) River and Harbor Act of 1899, 33 U.S.C. 403, *et seq.* (Also known as the Refuse Act of 1899.)
(x) Submerged Lands Act of 1953, P.L. 82-3167; 43 U.S.C. 1301, *et seq.*
(y) Surface Mining and Reclamation Act of 1977, P.L. 95-89; 30 U.S.C. 1201, *et seq.*
(z) Toxic Substances Control Act, P.L. 94-469; 15 U.S.C. 2601, *et seq.*
(aa) Watershed Protection and Flood Prevention Act, as amended, P.L. 83-566; 16 U.S.C. 1001, *et seq.*
(bb) Wild and Scenic Rivers Act, as amended, P.L. 90-542; 16 U.S.C. 1271, *et seq.*

2. EXECUTIVE ORDERS

(a) Executive Order 11593, Protection and Enhancement of the Cultural Environment. May 13, 1979 (36 FR 8921; May 15, 1971).
(b) Executive Order 11988, Floodplain Management. May 24, 1977 (42 FR 26951; May 25, 1977).
(c) Executive Order 11990, Protection of Wetlands. May 24, 1977 (42 FR 26961; May 25, 1977).
(d) Executive Order 11514, Protection and Enhancement of Environmental Quality, March 5, 1970, as amended by Executive Order, 11991, May 24, 1977.
(e) Executive Order 12088, Federal Compliance with Pollution Control Standards, October 13, 1978.
(f) Executive Order 12372, Intergovernmental Review of Federal Programs, July 14, 1982.
(g) Executive Order 12856, Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements, August 3, 1993.
(h) Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, February 11, 1994.

3. OTHER FEDERAL POLICIES

(a) Council on Environmental Quality Memorandum of August 11, 1980: Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing the National Environmental Policy Act.
(b) Council on Environmental Quality Memorandum of August 10, 1980: Interagency Consultation to Avoid or Mitigate Adverse Effects on Rivers in the National Inventory.
(c) Migratory Bird Treaties and other international agreements listed in the Endangered Species Act of 1973, as amended, Section 2(a)(4)

Chagrin Valley Engineering, Ltd.
22999 Forbes Road, Suite B
Cleveland, Ohio 44146-5667
440/439-1999
Fax 440/439-1969

May 9, 2006

U.S. Army Corps of Engineers
Buffalo District
1776 Niagara Street
Buffalo, NY 14207-3199

Attention: Ms. Patti McKenna

Re: EIS: Cleveland Harbor DMMP

Dear Ms. McKenna:

Thank you for taking the time recently to speak to me regarding the Corps Dredged Material Management Plan for Cleveland Harbor. As I mentioned in our telephone conversation I am the Village Engineer for the Village of Bratenahl, Ohio. I have been asked by Mayor John Licastro and Council to act as the Village's point person for this project.

Bratenahl, Ohio is located just east of Cleveland on the Lake Erie lakefront near existing Confined Disposal Facility (CDF) #14. Bratenahl is a quiet residential community with very little commercial development. The Village is a heavily wooded, green community that prides itself on its heritage and natural charm. In fact, the Bratenahl Land Conservancy was established to secure key parcels of land and sustain them for the benefits of the community.

In light of the above, the Mayor and Council were concerned when the Village recently received the draft Environmental Impact Statement (dated March 16, 2006) for the Dredged Material Management Plan for Cleveland Harbor. The Plan includes the possible installation of proposed CDF #8, located very close to Bratenahl. Bratenahl has worked diligently to sustain it's country like atmosphere and fears that the installation of CDF #8 would have a detrimental effect of the quality of life in the Village. The work required to install CDF #8 would be extensive, resulting in noise and odor that would be offensive to the residents of the Village. The lakefront views enjoyed by many of the residents would be adversely affected, possibility resulting in reduced property values.

The Village of Bratenahl respectfully requests that proposed CDF #8 be eliminated as a possible site for dredged material.

Thank you for involving the Village in the Environmental Impact Statement Process. Please do not hesitate to contact me if you have any questions or comments.

Respectfully submitted,

Donald P. Bierut, PE
Village Engineer

cc: Mayor John Licastro

OhioEPA
State of Ohio Environmental Protection Agency

STREET ADDRESS:
Lazarus Government Center
122 S. Front Street
Columbus, Ohio 43215

TELE: (614) 644-3020 FAX: (614) 644-3184

MAILING ADDRESS:
P.O. Box 1049
Columbus, OH 43216-1049

Martin P. Wargo, Chief
Environmental Analysis Section
U.S. Army Corps of Engineers-Buffalo District
1776 Niagara Street
Buffalo, New York 14207-3199

Re: Cleveland Harbor, Cuyahoga County, Operations and Maintenance of Dredged Material Management Plan (DMPP)

Dear Mr. Wargo:

Thank you for the opportunity to comment on the above-referenced document. As the principal environmental regulator in the State of Ohio, Ohio EPA is extremely interested in the Cleveland Harbor DMMP. While I understand the need to ensure that the Cleveland Harbor remains open and functional and fully support that goal, Ohio EPA also has a responsibility to ensure that the waters of the state are adequately protected.

I instructed staff from the Division of Surface Water to review this document, and their comments and questions are provided in the attached document. If you have any questions regarding these comments, you can contact Randy Bournique, Division of Surface Water, at (614) 644-2013 or via email at randy.bournique@epa.state.oh.us.

In the larger context, I am very concerned that insufficient time has been allotted to address the issue of the existing CDFs. If your projections are correct and the existing CDF capacity is exhausted in 2007, both of our agencies will then have to expend considerable resources in a short period of time to deal with this problem.

Ohio EPA is committed to addressing all of the issues related to the harbor maintenance dredging, and we look forward to working with you on our mutual interests in the Cuyahoga River Federal Navigation Channel.

Sincerely,

Joseph P. Koncelik
Director

JPK:rb

Bob Taft, Governor
Jennette Bradley, Lieutenant Governor
Christopher Jones, Director

Division of Surface Water Comments on the March 21, 2006
Scoping Information Packet for the Cleveland Harbor DMMP
April 20, 2006

1. On page 4, the data provided indicates that the average dredging volume per year between 1998 and 2005 is 305,000 cubic yards. Ohio EPA has only authorized 250,000 cubic yards of dredging in the 401 water quality certifications issued over this time period. It was our understanding that the 250,000 cubic yards estimate included a 20-25% excess in the event of an unusual amount of sedimentation occurring. Please explain the discrepancy in the sediment dredging volume as the current projection now estimates that the current Cleveland Confined Disposal Facility (CDF 10b) will reach capacity in 2007, 6 years earlier than anticipated.

2. Please evaluate how many more years contaminated sediments are anticipated in the Cuyahoga Navigation Channel. Since the contaminated material has been sequestered and upstream sources are continually being reduced, eventually the sediments should be clean enough for beneficial re-use or dredging volumes should be significantly reduced. Ohio EPA requests that the Corps evaluate the future sediment quality and quantity during this process. Ohio EPA would also like to see the completed report on the Cuyahoga River Sediment Transport Study. Ohio EPA requests that the Corps sample the sediments more frequently than once every 5 years to discern the trends for when the sediments would be considered "safe" enough for beneficial reuse.

3. Ohio EPA requests a detailed economic analysis of all the options proposed to be evaluated. The study should include the construction costs for all the alternatives as well as long-term maintenance and operation costs versus letting the river fill in and initiating barging or other alternative transportation methods.

4. Ohio EPA requests that the background section of the Environmental Impact Statement acknowledge the impact of the channel morphology on water quality and habitat degradation and that this is the cause of impairments in this section of the Cuyahoga River Area of Concern. The channel morphology, deepened to allow for commercial ship traffic and resulting slower time of travel, is the primary factor affecting dissolved oxygen levels. The instream dissolved oxygen is low due to a low instream re-aeration rate in a slow-moving, dredged navigation channel, even if there was no discharge loading.

5. Ohio EPA would like to encourage beneficial use of the dredge material as well as require more progress on the use of the fish bulkhead habitats along the river. All new bulkheads that need to be replaced along the navigation channel should incorporate one of the bulkhead habitat designs.

6. Per comments from the Ohio Department of Natural Resources Natural Heritage Database, there is one 1991 record of the potentially threatened Richardson's Pondweed (Potamogeton richardsonii) within the Whiskey Island area of Cleveland Harbor between the mouth of the Cuyahoga River and the ore docks to the west. Care should be taken to avoid natural areas that are being restored in the Cuyahoga River.

7. Please provide the most recent sediment data collected by the Corps for review by our technical staff.

8. Please explain how the Corps considers open lake placement of contaminated sediments that exceed the federal standard.

9. Ohio EPA requests a thorough review of Confined Disposal Facility (CDF) best management practices (BMPs), including soil washing techniques, that would allow clean uncontaminated sand to be returned to the nearshore environment.

10. Please provide a spreadsheet that shows the volumes of material added to CDF 10b and the sources (federal and private). Please explain if private parties that dispose of sediments in the CDFs pay the Corps for disposal.

11. Please provide a legible detailed map(s) of all the CDFs 1 through14, plus 10b, and including the location of cell 10a.

12. Please explain if it would ever be technically feasible to daylight the portion of Doan Brook that runs underneath CDF 14.

Mckenna, Patrice M LRB

From: Sanders, Randy [Randy.Sanders@dnr.state.oh.us]
Sent: Thursday, April 27, 2006 4:56 PM
To: Mckenna, Patrice M LRB
Subject: 06-0077; EIS for Cleveland Harbor Maintenance Dredging.
Attachments: image001.gif; image001.gif; image001.gif; 06-0077.jpg

ODNR COMMENTS TO Patti McKenna, U.S. Army Corps of Engineers, Buffalo District, 1776 Niagara Street, Buffalo New York, 14207-3199.

Location: Cleveland Harbor is located on Lake Erie at the mouth of the Cuyahoga River.

Project: The USACE is preparing an EIS for the proposed Cleveland Harbor Dredged Material Management Plan and other alternatives to develop a long-term (20-year) strategy for providing viable dredged material placement alternatives that would meet the needs of maintaining the Federal channels at Cleveland Harbor.

The Ohio Department of Natural Resources (ODNR) has completed a review of the above referenced project. These comments were generated by an inter-disciplinary review within the Department. These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), the National Environmental Policy Act, the Coastal Zone Management Act, Ohio Revised Code and other applicable laws and regulations. These comments are also based on ODNR's experience as the state natural resource management agency and do not supersede or replace the regulatory authority of any local, state or federal agency nor relieve the applicant of the obligation to comply with any local, state or federal laws or regulations.

Rare and Endangered Species: The ODNR Natural Heritage Database contains the following data in the project area, as shown on the attached map:
A. Cleveland Lakefront State Park - ODNR, Division of Parks & Recreation
1. *Potamogeton richardsonii* - Richardson's Pondweed, potentially threatened
2. *Bartramia longicauda* - Upland Sandpiper, threatened
3. *Potamogeton richardsonii* - Richardson's Pondweed, potentially threatened

Fish and Wildlife: The ODNR, Division of Wildlife recommends no in-water work from March 15 to June 30 to reduce impacts to aquatic species.

Coastal Management: The Office of Coastal Management comments that many of the alternatives outlined in section 4.0 will likely require a federal consistency determination. Please coordinate all related activities with the ODNR Office of Coastal Management as early as possible.

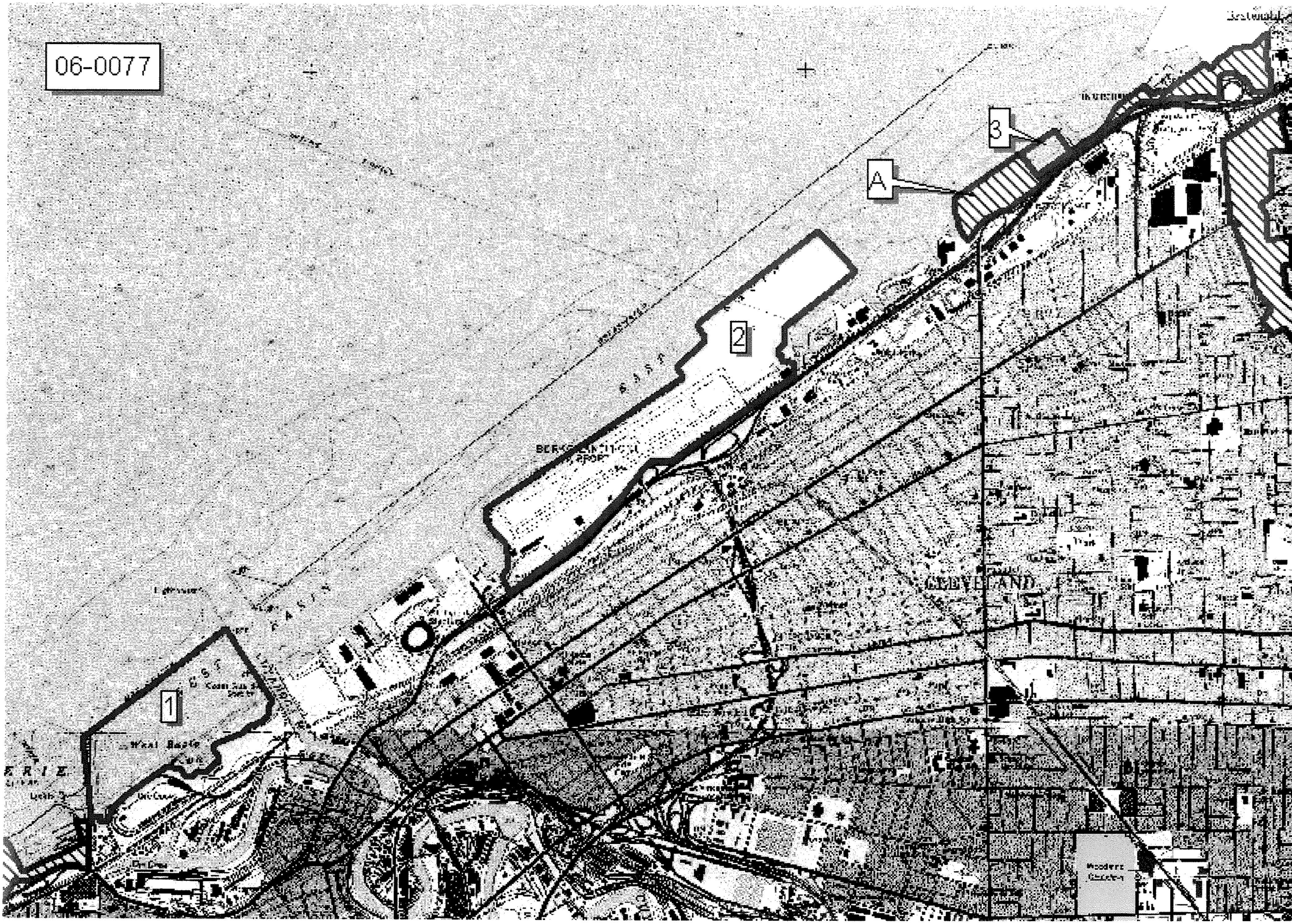
Geological Survey: Proposed CDFs 2, 3, 4, 5, 6, 7A, 7B, and 7C probably will not have a significant adverse impact on coastal processes or coastal sand resources. Proposed CDF 8 may impound sand transported westward by northeast storm waves. Although there is not a lot of sand on the downdrift (east) side of Cleveland Harbor, waves transport sand westward along the east part of the Cleveland waterfront, depositing sand in the intake channel at the power plant and atop the sidewalk on east of E 55th Street Marina. If sand accumulates shoreward of the proposed CDF 8 provision should be made for returning the sand to the littoral system farther east.

The Corps should continue to explore opportunities for beneficial reuse of sandy sediment deposited in the CDFs. For a number of years, the Corps has been using the west end of Dike 10B for disposal of sandy sediment dredged from the upstream end of the navigation channel. The west end of Dike 10B now contains primarily sandy sediment; however, chemical analysis of this sediment in 2005 showed the sand contained elevated levels of some contaminants. Washing the sand to remove traces of fine-grained sediment and contaminants might make the sediment better suited for nearshore disposal east of Cleveland. Using sand from the CDF to nourish the littoral system east of Cleveland would extend the life of the CDFs, would forestall the need to construct additional CDFs, and would mitigate some of the harbor's impact on regional sand transport.

Special Flood Hazard Area: The proposed project may or may not be located in a Special Flood Hazard Area. To assist you in this determination, please contact the community's floodplain administrator. A list of community floodplain administrators can be found on the ODNR - Division of Water website at http://www.dnr.state.oh.us/water/floodpln/. To view a copy of a Flood Insurance Rate Map for your project area, you can either contact the community floodplain administrator, or obtain a copy online from the FEMA Flood Map Store at http://store.msc.fema.gov/.

ODNR appreciates the opportunity to provide these comments. Please contact Randy Sanders at 614.265.6344 if you have questions about these comments or need additional information.

Randall E. Sanders
Environmental Administrator
Division of Real Estate & Land Management
Ohio Department of Natural Resources
2045 Morse Rd, C4
Columbus, Ohio 43229-6693
614.265.6344
fax 614.267.4764
randy.sanders@dnr.state.oh.us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CLEVELAND
ERIE

U.S. Department
of Transportation
**Federal Aviation
Administration**

**Detroit Airports District Office
11677 South Wayne Road
Suite 107
Romulus, MI 48174**

April 24, 2006

U.S. Army Corps of Engineers
Buffalo District
ATTN: Patti McKenna
1776 Niagara Street
Buffalo, NY 14207-3199

Dear Ms. McKenna:

Cleveland Harbor Dredged Material Management Plan
Public Scoping Information Packet

We received a copy of the Scoping Information Packet for the Cleveland Harbor Dredged Material Management Plan (DMMP) from Dana Ryan of the Cleveland Airport System on April 10, 2006. We also received a copy of Mr. Ryan's comments on the DMMP dated April 13, 2006. We agree with his comments and also offer the following:

1. The existing Confined Disposal Facilities (CDF) are considered wildlife attractants. Documented bird/aircraft hazards at Burke Lakefront Airport (BKL) make the CDF's an incompatible land use. FAA has repeatedly expressed concern regarding the continuation of the CDF's without the City and the COE addressing the wildlife hazard created by the dredge disposal operations.
2. The proposed CDF's may increase the bird/aircraft hazards at BKL.
3. Mitigation measures to reduce the bird/aircraft hazards for both the existing and proposed CDF's need to be addressed.
4. Please include our office and the local U.S. Department of Agriculture Wildlife Services, 1501 North Marginal Road, Cleveland OH 44114 in all future correspondence on this project.

If you have any questions, please call us.

Sincerely,

David J. Welhouse

David J. Welhouse
Project Engineer

cc: Dana Ryan, DPC
Khalid Bahhur, DPC
John Lott, FAA
Ed Cleary, FAA
Randy White, USDA

CUYAHOGA COUNTY
PLANNING
COMMISSION

323 Lakeside Avenue West, Suite 400 ≡ Cleveland, Ohio 44113 ≡ Voice 216/443-3700 ≡ Fax 216/443-3737
e-mail: cpc@planning.co.cuyahoga.oh.us / web site: planning.co.cuyahoga.oh.us / TDD:1-800-750-0750

April 13, 2006

Ms. Patti McKenna
U.S. Army Corps of Engineers
Buffalo District
1776 Niagara Street
Buffalo, NY 14270-3199

RE: **Cleveland Harbor Dredged Material Management Plan**

Dear Ms. McKenna,

After reviewing the Public Scoping Information Packet for the proposed Cleveland Harbor Dredged Material Management Plan, we at the Cuyahoga County Planning Commission believe the Army Corps of Engineers has a unique opportunity as it develops a long-term strategy for the management of dredged material at Cleveland Harbor. It is evident that to date, we have not found a sustainable method of dredging the Cuyahoga River. Merely developing a confined disposal facility is not the answer. We propose that the Army Corps strongly consider a whole systems approach consistent with the goals of the Cuyahoga Valley Initiative. Therefore, the alternatives of best management practices and beneficial use should be paramount in this discussion.

It is important to remember that the Cuyahoga River drains 813 square miles in Cuyahoga, Geauga, Portage, and Summit Counties. The cumulative effect of land use throughout the entire watershed affects what ends up in the shipping channel. Our current building patterns affect the natural hydrology of the stream; therefore it is very important to aggressively pursue practices that help to prevent increased sedimentation. From construction practices to stormwater quality measures, thinking holistically about how sediment reaches the shipping channels is crucial for minimizing the amount of dredging that takes place. We support efforts that reduce the amount of sediment that must be removed from the Navigation Channel, as well as the frequency of dredging.

When dredging must take place, we support the use of best practices that would limit the level of disturbance that currently occurs with the use of mechanical means to maintain depth. The present practice of using clam shell dredges to remove sediment results in the dispersion of fine particles, including toxic materials. The use of hydraulic dredges can limit the negative effects of sediment disturbance. We recommend that the Army Corps explore this option and other practices suitable for the Cuyahoga River.

The beneficial use of the dredged material is also extremely important. Due to years of toxic chemical releases, trapping sediment before it reaches the shipping channel is necessary for reuse. Beneficial reuse provides opportunities for innovation. For example, sediment from the Cuyahoga River should be reused in landscaping or low impact development practices throughout Northeastern Ohio, provided that the sediment is proven safe for such uses.

The Cleveland Harbor Dredged Material Management Plan offers the opportunity for the Army Corps and the communities of the Cuyahoga Watershed to think differently about dredging and sedimentation. By minimizing the level and frequency of dredging, using best practices to ensure project depth as well as water quality, and taking a proactive, concerted approach to using reclaimed material, the Army Corps of Engineers may not only achieve its mission of maintaining the Navigation Channel, but can also have a positive impact on the quality of life for those that live in Northeast Ohio.

Sincerely,

Paul Alsenas
Director

CLEVELAND™
AIRPORT SYSTEM

CLE CLEVELAND HOPKINS INTERNATIONAL AIRPORT

BKL CLEVELAND BURKE LAKEFRONT AIRPORT

April 13, 2006

U.S. Army Corps of Engineers
Buffalo District
ATTN: Patti McKenna
1776 Niagara Street
Buffalo, NY 14207-3199

Re: Cleveland Harbor Dredged Material Management Plan

Dear Ms. McKenna:

The U.S. Army Corps of Engineers (USACE) is proposing an environmental impact statement (EIS) that will address the ramifications of any future management of dredged material removed from Cleveland Harbor. The Cleveland Airport System (CAS) has received the information packet for this proposed action and, respectfully, offers the following comments for consideration.

The Dredged Material Management Plan (DMMP) for any future confined disposal facility has the potential to impact aircraft activity occurring at Burke Lakefront Airport. As such, the Federal Aviation Administration Detroit Airports District Office and the local office for the US Department of Agricultural Wildlife Services have been intimately involved in the on-going DMMP. CAS understands that neither office received the USACE scoping packet. Accordingly, we took the liberty of forwarding the information to both and we ask that each agency be included on all future distributions.

Section 5.0 of the scoping packet addresses the categories of potential impacts that would be explored. The listing is comprehensive, however, we call attention to three specific items that may or may not be included within a specific category. Each is deserving of attention and public disclosure:

1. Wildlife hazard: the alternative confined disposal facilities are all located within 10,000 linear feet of Burke Lakefront Airport. These facilities are known attractants for birds and other wildlife, which could pose risk to aviation. There are means to mitigate this issue that should be brought to light during the investigation.

Cleveland Hopkins International Airport
5300 Riverside Drive
P.O. Box 81009
Cleveland, OH 44181-0009
USA
1 216 265 6000

Cleveland Burke Lakefront Airport
1501 North Marginal Road
Cleveland, OH 44114-3759
USA
1 216 781 6411

clevelandairport.com

2. Land use impacts: the potential for altering on-shore land use is evident in Alternatives 4, 5, and 14. For instance, Alternate 4 suggests that relocation of the US Coast Guard, USACE and the US Naval Reserve before CDF construction could start.

3. Health: Measure C indicates that spoil from Cleveland Harbor is unsuitable for open lake placement. Recognizing that humans would eventually occupy whatever CDF alternative is selected, the effort should assess the potential for human exposure to contaminants and means to mitigate potential health issues.

In closing, the importance of the USACE effort to provide Cleveland with a future CDF can not be understated. The CAS comments on the EIS scope are given with the intent strengthening the scope and ensuring a successful project. Additional comments will be forthcoming regarding the project alternatives and means to mitigate wildlife hazard. Meanwhile, we appreciate the opportunity to provide you with our initial thoughts.

Sincerely,

Dana Ryan

Dana Ryan
Chief of Planning

Cc: D. Welhouse, FAA
C. Hicks, USDA

MARCH 3, 1849

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
6950 Americana Parkway, Suite H
Reynoldsburg, Ohio 43068-4127

(614) 469-6923 / FAX (614) 469-6919

April 7, 2006

Patti McKenna
U.S. Army Corps of Engineers
Buffalo District
1776 Niagara Street
Buffalo, NY 14207-3199

Dear Ms. McKenna:

This is in response to the U.S. Army Corps of Engineers Cleveland Harbor Dredged Material Management Plan Scoping Information Packed for the proposed future management of dredged material in Cleveland Harbor, Cuyahoga County, Ohio we received on March 20, 2006.

There are no Federal wilderness areas, wildlife refuges, or designated Critical Habitat within the vicinity of the proposed site.

ENDANGERED SPECIES COMMENTS: The proposed project lies within the range of the **Indiana bat** (*Myotis sodalis*), a Federally-listed endangered species. Since first listed as endangered in 1967, their population has declined by nearly 60%. Several factors have contributed to the decline of the Indiana bat including the loss and degradation of suitable hibernacula, human disturbance during hibernation, pesticides, and the loss and degradation of forested habitat, particularly stands of large, mature trees. Fragmentation of forest habitat may also contribute to declines. Summer habitat requirements for the species are not well defined but the following are considered important:

1. Dead or live trees and snags with peeling or exfoliating bark, split tree trunk and/or branches, or cavities, which may be used as maternity roost areas.
2. Live trees (such as shagbark hickory and oaks) which have exfoliating bark.
3. Stream corridors, riparian areas, and upland woodlots which provide forage sites.

Should the proposed site contain trees or associated habitats exhibiting any of the characteristics listed above, we recommend that the habitat and surrounding trees be saved wherever possible. If the trees must be cut, further coordination with this office is requested to determine if surveys are warranted. Any survey should be designed and conducted in coordination with the Endangered Species Coordinator for this office.

The project area lies within the range of the **bald eagle** (*Haliaeetus leucocephalus*), a Federally-listed threatened species. We recommend that you contact Mr. Mark Shieldcastle, with the Ohio Department of Natural Resources, Division of Wildlife, (419) 898-0960, for the location(s) of the eagle nest(s) in the county. If any nests are located within ½ mile of the project site, further coordination with this office is necessary. If the nest is active, we recommend that work at the site be restricted from mid-January through July to allow pre-nesting activities, incubation, and raising of the young.

The proposed project lies within the range of the **piping plover** *(Charadrius melodus)*, a Federally listed endangered species. Plover habitat includes sand or pebble beaches with sparse vegetation along the shore of Lake Erie. If the proposed project is expected to impact habitat of this type, further consultation with this office will be necessary.

These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), the Endangered Species Act of 1973 (ESA), as amended, and are consistent with the intent of the National Environmental Policy Act of 1969 and the U. S. Fish and Wildlife Service's Mitigation Policy. Please note that consultation under section 7 of the ESA may be warranted for this project if suitable habitat for the Indiana bat may be impacted by this project. This letter provides technical assistance only and does not serve as a completed section 7 consultation document.

We appreciate this opportunity to provide the above comments. If you have questions, or if we may be of further assistance in this matter, please contact Angela Zimmerman at extension 22 in this office.

Sincerely,

Mary Knapp

Mary Knapp, Ph.D.
Supervisor

cc: ODNR, DOW, SCEA Unit, Columbus, OH

U.S. Department of Housing and Urban Development

Ohio State (Columbus) Office
Office of Community Planning and Development
200 North High Street
Columbus, Ohio 43215-2499

April 5, 2006

Environmental Analysis Section
Attention: Patti McKenna
Department of the Army
U.S. Army Engineer District, Buffalo
1776 Niagara Street
Buffalo, N.Y. 14207-3199

Dear Ms. McKenna:

This is in response to the request for comments concerning the project listed below. The U.S. Department of Housing and Urban Development has determined that the project is in the public interest and supports the project.

PUBLIC SCOPING
ENVIRONMENTAL IMPACT STATEMENT
CLEVELAND HARBOR, CUYAHOGA COUNTY, OHIO
DREDGED MATERIAL MANAGEMENT PLAN

Thank you for the opportunity to comment. If you should require any further input from HUD, I may be reached at (614) 469-5737, x8252 or by email at ross_carlson@hud.gov.

Sincerely,

Ross S. Carlson
Environmental Officer

United States Department of the Interior

National Park Service

Midwest Region
601 Riverfront Drive
Omaha Nebraska 68102-4226

L7619(MWR-P/G)
x39-00649,668,852,949,975)

MAR 2 7 2006

U.S. Army Corps of Engineers
Buffalo District
Attention: Ms. Patti McKenna
1776 Niagara Street
Buffalo, New York 14207-3199

Dear Ms. McKenna:

This is in response to the Public Scoping Information Packet for the Environmental Impact Statement for the Dredged Material Management Plan, Cleveland Harbor, Cuyahoga County, Ohio. These comments are provided on behalf of Regional Director Ernest Quintana who has asked me to respond to your scoping document.

The proposed Cleveland Harbor Dredged Material Management Plan, if implemented, could have impacts to sites funded with assistance from the Land and Water Conservation Fund (L&WCF). As a result, these sites are encumbered by Section 6(f)(3) of the L&WCF Act of 1965, as amended (Public Law 88-578), which states: "No property acquired or developed with assistance under this section shall, without the approval of the Secretary, be converted to other than public outdoor recreation uses."

Our findings show that L&WCF assistance was provided to several sites near the proposed project area. These sites include, but are not limited to, the following L&WCF projects:

Project Number	Project Name	Project Sponsor
29-00649	The Flats Development	City of Cleveland
39-00668	Cleveland Lakefront	Dept. of Natural Resources
39-00852	The Flats II	City of Cleveland
39-00949	Cleveland Edgewater Area	Dept. of Natural Resources
39-00975	Cleveland Lakefront Bikeway	Dept. of Natural Resources

The U.S. Army Corps of Engineers (USACE), Buffalo District, should consult with the official who administers the L&WCF program in Ohio to determine whether any impacts will occur at these sites. Please contact Mr. Samuel W. Speck, Director, Department of Natural Resources, 2045 Morse Road, Building D-3, Columbus, Ohio 43229.

These comments are provided as informal technical assistance and are not intended to reflect our response to any document which may be prepared in this matter to comply with the National Environmental Policy Act of 1969, as amended. If you have any questions regarding these comments, please contact me at 402-661-1550.

Sincerely,

Marilyn K. Gillen

Marilyn K. Gillen
Outdoor Recreation Planner
Partnerships/Grants

DEPARTMENT OF DEFENSE

Department of The Army; Corps of Engineers

Intent To Prepare a Draft Environmental Impact Statement for a Proposed Dredged Material Management Plan for Cleveland Harbor, OH

AGENCY: Department of the Army, U.S. Army Corps of Engineers, DoD.

ACTION: Notice of intent.

SUMMARY: Pursuant to Section 102(2)(c) of the National Environmental Policy Act (NEPA) of 1969 as implemented by the Council on Environmental Quality regulations (40 CFR Parts 1500–1508) and Public Law 102–484 Section 2834, as amended by Public Law 104–106 Section 2867, the Department of the Army hereby gives notice of intent to prepare a Draft Environmental Impact Statement (EIS) for the subject Dredged Material Management Plan (DMMP). The Buffalo District of the U.S. Army Corps of Engineers will be the lead agency in preparing the EIS.

The EIS will consider Federal actions associated with the development of a DMMP for the Federal harbor in the city of Cleveland, Cuyahoga County, OH. The DMMP is a study conducted to develop a long-term (20-year) strategy for providing viable dredged material placement alternatives that would meet the needs of maintaining the Federal channels at Cleveland Harbor. The overall goal of the DMMP is to develop a plan to maintain channels necessary for commercial navigation within Cleveland Harbor and to conduct dredged material placement in the most economically and environmentally sound manner, and maximize the use of dredged material as a beneficial resource.

FOR FURTHER INFORMATION CONTACT: Mr. Michael Asquith, Project Manager, Buffalo District, Corps of Engineers, CELRB–PM–PM, 1776 Niagara Street, Buffalo, NY 14207–3199, telephone (716) 879–4352, or Ms. Patti McKenna, NEPA Coordinator, Buffalo District, Corps of Engineers, 1776 Niagara Street, Buffalo, NY 14207–3199, Telephone: (716) 879–4367.

SUPPLEMENTARY INFORMATION: Cleveland Harbor is located on Lake Erie at the mouth of the Cuyahoga River. Included in the study area are the Outer Harbor and Cuyahoga River Channels. The harbor is protected by a breakwater system: an east breakwater (20,970 feet long), a west breakwater (6,048 feet long), and the east and west arrowhead breakwaters (each measuring 1,250 feet). Cleveland Harbor is dredged twice each year. The average dredging volume per year from 1998 through 2005 is 305,000 cubic yards, which includes Federal and non-Federal dredging activities. In accordance with joint U.S. Environmental Protection Agency (USEPA) and the U.S. Army Corps of Engineers (USACE) protocols contained in the Great Lakes Dredged Material Testing and Evaluating Manual (1998), all sediment dredged from Cleveland Harbor and Cuyahoga River Channels is unsuitable for open lake and nearshore placement. All dredged material is currently placed in a Confined Disposal Facility (CDF). Since the 1960s, five CDFs have been constructed at Cleveland Harbor (9, 10B, 12, 13, and 14). The current operational CDF (10B) is nearing design capacity. Planning efforts are underway for interim placement solutions at CDF 10B. However, to address long-term dredging and dredged material management needs, additional placement sites for dredged material disposal must also be made available.

Proposed Action: In accordance with U.S. Army Corps of Engineers Regulation 1105–2–100, a DMMP is prepared for a Federal navigation project to ensure that maintenance dredging activities are performed in an environmentally acceptable manner, use sound engineering techniques, are economically warranted, and that sufficient confined disposal facilities are available for at least the next 20 years. The proposed DMMP will focus on the management of dredged material from maintaining Federal navigation channels at Cleveland Harbor, and will take into consideration non-Federal dredging projects permitted by the Buffalo District. The approved DMMP will be consistent with sound engineering practices and meet all Federal environmental compliance standards, including those established by the Clean Water Act. In addition, the DMMP will be consistent with State plans such as the Ohio Coastal Zone Management Program.

Reasonable Alternatives: The alternatives for the DMMP will consist of an array of disposal and beneficial use options. It is Corps of Engineers planning policy to consider all practicable and relevant alternative management measures. Options for managing dredged material at Cleveland Harbor that are being considered include the following: (1) Open-lake Placement. To date, all sediment dredged from Cleveland Harbor and Cuyahoga River Channels is unsuitable for open lake placement; (2) Confined Disposal. Additional capacity would be created in one of the existing CDFs through adaptive management and/or the construction of internal dikes; (3) New Confined Disposal Facility. The construction of a new in-water CDF will also need to be evaluated. There are eight potential locations that are being assessed; (4) Beneficial Use. Dredged material would be transported to upland sites for use as cover or fill, with particular emphasis on the value of restoring or creating habitat; (5) Best Management Practices. Measures will be considered to reduce erosion and sedimentation within the watershed and consequently reduce harbor dredging needs; and (6) ''No Action''. No Federal action would be taken to address dredging needs at Cleveland Harbor. The EIS will address measures, alternatives and impacts to the selected or preferred alternative(s).

Scoping Process: The Corps of Engineers invites affected Federal, State and local agencies, affected Native American tribes, and other interested organizations and individuals to participate in the development of the EIS. The Corps of Engineers anticipates conducting a public scoping meeting for this EIS in the summer of 2006. The exact date, time and location of this meeting has not yet been determined. This information will be publicized once the meeting arrangements have been made.

The Draft EIS is currently scheduled to be available for public review in June 2007. The Final EIS is currently scheduled to be available for public review in January 2008.

Brenda S. Bowen,

Army Federal Register Liaison Officer.

[FR Doc. 06–2603 Filed 3–16–06; 8:45 am]

BILLING CODE 3710–GP–M

DEPARTMENT OF EDUCATION

Notice of Proposed Information Collection Requests

AGENCY: Department of Education.

SUMMARY: The IC Clearance Official, Regulatory Information Management Services, Office of Management, invites comments on the proposed information collection requests as required by the Paperwork Reduction Act of 1995.

DATES: Interested persons are invited to submit comments on or before May 16, 2006.

SUPPLEMENTARY INFORMATION: Section 3506 of the Paperwork Reduction Act of 1995 (44 U.S.C. Chapter 35) requires that the Office of Management and Budget (OMB) provide interested Federal agencies and the public an early

CLEVELAND HARBOR
OPERATIONS & MAINTENANCE
(DREDGED MATERIAL MANAGEMENT PLAN - EAST 55th STREET CDF)
CUYAHOGA COUNTY, OHIO

SECTION 404(a) PUBLIC NOTICE AND
SECTION 404(b) (1) EVALUATION

U.S. ARMY CORPS OF ENGINEERS
BUFFALO DISTRICT
AUGUST 2009

DEPARTMENT OF THE ARMY
BUFFALO DISTRICT, CORPS OF ENGINEERS
1776 NIAGARA STREET
BUFFALO, NEW YORK 14207-3199

REPLY TO
ATTENTION OF:

Environmental Analysis Team

PUBLIC NOTICE

CLEVELAND HARBOR
OPERATIONS & MAINTENANCE
(DREDGED MATERIAL MANAGEMENT PLAN - EAST 55th STREET CDF)
CUYAHOGA COUNTY, OHIO

This Public Notice has been prepared and distributed pursuant to Section 404(a) of the Clean Water Act (33 USC 1344). Its purpose is to specify the nature and extent of dredged and/or fill material that would be discharged into waters of the United States by implementation of the proposed project. This notice provides an opportunity for any person who may be affected by such discharge to submit comments or request a public hearing. A Section 404(b)(1) Evaluation is included with this Public Notice, which evaluates the impacts of the proposed discharge of dredged and/or fill material into waters of the United States.

The U.S. Army Corps of Engineers (USACE)-Buffalo District is responsible for maintaining harbor structures and authorized depths within the authorized Federal navigation channels. It is a primary objective of the USACE Maintenance Dredging Program to meet the expectations of the dredging customers and stakeholders consistent with the Section 404(b)(1) guidelines and available Federal funding.

The existing Federal navigation project at Cleveland Harbor is located along the southern shore of Lake Erie in Cuyahoga County, Ohio. The harbor is situated approximately 176 miles southwest of Buffalo, New York, and 96 miles east of Toledo, Ohio (Figure 1). The harbor consists of a breakwater-protected Outer Harbor that encompasses about 1,300 acres (five miles long and 16,000 to 2,400 feet wide). The harbor's breakwater system is comprised of a 20,970–foot long East Breakwater, a 6,048-foot long West Breakwater connected to the shore (with a 201-foot gap), and East and West Arrowhead Breakwaters each 1,250 feet long. The Federal navigation channel extends approximately 5.5 miles up the Cuyahoga River (Figure 3).

Since the 1960's, five confined disposal facilities (CDF) have been constructed in Cleveland Harbor (Figure 2). There is currently one operational facility (CDF 10B), which is currently maintained by the Buffalo District. The remaining four facilities (CDFs 9, 12, 13, and 14) were transferred to the local project sponsors (City of Cleveland and Cleveland-Cuyahoga County Port Authority) once the facilities were filled to their respective design capacities. USACE recently acquired access and use of CDFs 9 and 12 to provide additional short term capacity for dredged material.

USACE-Buffalo District continually monitors the current CDF capacity at Cleveland Harbor as it relates to dredging and dredged material management needs at the harbor. A Dredged Material Management Plan (DMMP)/Environmental Impact Statement (EIS) has been prepared by USACE-Buffalo District to formulate a plan for the maintenance dredging and disposal of dredged materials from Cleveland Harbor. The DMMP/EIS evaluated alternatives in order to provide a minimum of 20 years of dredged material disposal.

The Federal objective of water and related land resources project planning is to contribute to National Economic Development consistent with protecting the Nation's environment, pursuant to Federal, State and local environmental protection statutes and regulations, as well as applicable Executive Orders, Memoranda, and other Federal planning requirements.

In the DMMP/EIS, in addition to considering the No Action Plan (Without Project Condition) alternative, USACE considered a wide array of alternatives. These plans were evaluated for engineering and economic feasibility, environmental and social acceptability, and their ability to meet the planning objectives. The recommended plan was identified as the cost effective, technically feasible, environmentally sound, and socially acceptable.

The following description is for the proposed construction of a new CDF at the East 55th Street site (Also see Section 2.13.1 of the Cleveland Harbor DMMP/EIS). To the south, the East 55th Street site would be bound by an improved East 55th Street marina breakwater, the natural shoreline at the lakeward terminus of East 55th Street, and a to be constructed perimeter wall/dike. A portion of the eastern boundary would be formed by the existing First Energy circulating water intake and the remainder of the perimeter would be formed by steel sheet pile walls, which could support vessel mooring if any future development of the site warrants.

The proposed CDF would encompass approximately 157 acres and would consist of three cells. It is expected that CDF construction would begin in 2012 with Cell 1 and would be constructed over a three-year period. The next cell would be constructed over a three-year period beginning in 2019 and the third cell would be constructed beginning in 2024. It is anticipated that the construction of the proposed CDFs will utilize marine construction equipment for placement and grading of the rubblemound stone structure and to drive the sheet steel pile cells.

Under routine harbor maintenance operations, approximately 300,000 cubic yards of dredged material would be dredged from Cleveland Harbor and placed annually into the proposed East 55th Street CDF by USACE contractors. Dredging operations at Cleveland Harbor generally are scheduled to be performed during the period between May until November each year.

Sediment sampling at the harbor is normally conducted once every five years. The purpose of the sediment sampling is to assess the physical and chemical characteristics of the sediments and determine any particularized management needs. Recent sediment and associated water quality sampling and analyses conducted indicate that the material to be dredged is comprised almost entirely of silts and clays and some sands. Chemical and toxicity analysis of the sediment and affected water samples classifies all sediments, with the periodic exception of those collected near the upstream limit of the Federal project, as being contaminated and not suitable for unconfined open-lake placement. (USACE 2007)

In addition to maintenance dredging of the Federal channels, other public and private interests may apply for Department of the Army (DA) permits to dredge areas adjacent to the Federal channel and to discharge these materials at the proposed CDF. The attached Section 404(b)(l) Evaluation also applies to DA permits for the placement of dredged material resulting from these activities. Separate evaluations would be performed for permit requests involving the placement of material at other sites.

Corps of Engineers Regulation ER 200-2-2, "Policy and Procedures for Implementing the National Environmental Policy Act (NEPA)", provides guidance for insuring that the Corps actions comply with the National Environmental Policy Act (NEPA). This project is being reviewed under applicable Federal and State environmental protection statutes and regulations, and applicable Executive Orders and Memoranda. Previous NEPA documentation for Cleveland Harbor includes ***Final Environmental Impact Statement (FEIS)Operations and Maintenance Diked Disposal Area Site No. 12, Cleveland Harbor, Cuyahoga County Ohio (1973), FEIS, Operation and Maintenance, Cleveland Harbor, Ohio (1974); and FEIS, Harbor Maintenance and Confined Disposal Facility Site 10B, Cleveland Harbor, Ohio (1994).*** These documents, and supplemental documentation, have been filed with the USEPA. Copies are available for examination at the USACE, Buffalo District office.

The Draft DMMP/EIS [including this Clean Water Act Section 404(a) Public Notice and Section 404(b)(1) Evaluation] are being coordinated for agency and public review and comment. If there are no substantial objections to the proposed plan, a Record of Decision will be signed and coordinated and the project would proceed into Plans and Specifications, Contract, and Construction.

The proposed CDF site has not been previously designated by the Administrator of the U. S. Environmental Protection Agency. Designation of the proposed CDF site for receipt of fill and dredged material associated with construction and operation of this Federal project has been made through the application of the Section 404(b)(1) Guidelines. Preliminary assessment of proposed project impacts (as discussed in the Section 404(b)(l) Evaluation applying the guidelines for specification of disposal sites for dredged or fill material in 40 CFR 230) concludes that the proposed work would not cause unacceptable disruption to water quality uses of the affected aquatic ecosystem. Section 401 State Water Quality Certification (WQC) from the Ohio Environmental Protection Agency is required for this action. USACE-Buffalo District submitted an application for WQC to the Ohio Environmental Protection Agency on 21 August 2009.

Based on the review of available environmental data and consultation with the U.S. Fish and Wildlife Service and Ohio Department of Natural Resources, it has been determined that the proposed work will not affect any species proposed or designated by the U.S. Department of the Interior as threatened or endangered, nor will it affect the critical habitat of any such species. Therefore, unless information forthcoming indicates otherwise, no further consultation pursuant to Section 7 of the Endangered Species Act Amendments of 1978 will be undertaken with the U.S. Fish and Wildlife Service.

Consultation with the National Register of Historic Places (NRHP), Ohio Historic Preservation Office and other historic preservation interests and an evaluation of the project’s area of potential effect indicate that no properties listed in or eligible for listing in the NRHP would be affected by this project. By this Notice, the National Park Service is advised that presently unknown archeological, scientific, prehistoric, or historic data may be lost or destroyed by the work to be accomplished.

The proposed project would be constructed in a manner consistent to the maximum extent practicable with the State of Ohio Coastal Management Program, as determined by the Federal Consistency Determination. Concurrence with this determination has been requested from the Ohio Department of Natural Resources on 21 August 2009.

This Notice is published in conformance with Title 33, Code of Federal Regulations 337.1. Copies of this Notice (or notification thereof) have been furnished to Federal, State and local agencies, and interests including:

U.S. Environmental Protection Agency
U.S. Department of the Interior, Fish and Wildlife Service
U.S. Department of the Interior, National Park Service
U.S. Coast Guard
Ohio Environmental Protection Agency
Ohio Department of Natural Resources
Ohio Historic Preservation Office
Cuyahoga County
City of Cleveland
Cleveland/Cuyahoga County Port Authority

Any interested parties and/or agencies desiring to express their views concerning the proposed discharges may do so by filing their comments, in writing, no later than 4:30 p.m., 30 days from the date of the issuance of this Notice. A lack of response will be interpreted as meaning that there is no objection to the proposed work.

Any person who has an interest which may be affected by the discharge of the dredged or fill material may request a public hearing. The request must be submitted in writing to the District Commander within 30 days of the date of issuance of this Notice and must clearly set forth the interest which may be affected and the manner in which the interest may be affected by this activity.

Correspondence pertaining to this matter should be addressed to: District Commander, U.S. Army Corps of Engineers-Buffalo District, 1776 Niagara Street, Buffalo, New York 14207-3199; ATTN: Ms. Christine Cardus. If you have any questions or require any additional information, please contact Ms. Cardus of my staff at number: 716- 879-4130, Fax: 716-879-4357, or Email: christine.m.cardus@usace.army.mil

Martin P. Wargo
MARTIN P. WARGO, PWS
Chief, Environmental Analysis Team

NOTICE TO POSTMASTER: It is requested that the above Notice be conspicuously displayed for 30 days from the date of its issue.

SECTION 404(b)(l) EVALUATION

CLEVELAND HARBOR
OPERATIONS & MAINTENANCE
(DREDGED MATERIAL MANAGEMENT PLAN - EAST 55th STREET CDF)
CUYAHOGA COUNTY, OHIO

INTRODUCTION

Section 404 and Section 404(b)(1)of the Clean Water Act (33 USC 1344) requires the evaluation of discharge sites and the water quality effects of discharges of dredged and/or fill material into waters of the United States. The evaluation for the proposed project has been prepared using U.S. Environmental Protection Agency guidelines in conjunction with those of the Secretary of the Army for civil works. The evaluation includes all aspects of the project which involve the discharge of dredged and/or fill material.

1. PROJECT DESCRIPTION

1.1 Location

1.1.1 Cleveland Harbor is located on the south shore of Lake Erie, at the mouth of the Cuyahoga River, approximately 176 miles southwest of Buffalo, New York, and 96 miles east of Toledo, Ohio (Figure 1). The commercial harbor includes a breakwater-protected Outer Harbor and Cuyahoga River and Old River navigation channels. The proposed East 55th Street CDF would be constructed within the East Basin of the Outer Harbor. To the west, the East 55th Street site would be bound by an improved East 55th Street marina breakwater. On the south, the CDF would be bound by the natural shoreline near the lakeward terminus of East 55th Street and a to-be-constructed perimeter dike. The eastern boundary would be formed by the existing First Energy circulating water intake (necessary improvements would be made to the structure) and to-be-constructed dikes.

1.2 General Description

1.2.1 The proposed plan would involve the construction of a new CDF at Cleveland Harbor. After completion of the CDF, bottom sediments to be dredged annually from the Cleveland Outer Harbor, Old River Channel, Cuyahoga River Channel, and some permitted adjacent channels and placed into the CDF. Anticipated volume is 6,850,000 cubic yards, which would provide approximately 20 years of capacity and be operational from 2015 through 2034.

1.2.2 The CDF would be constructed as a series of three optimally sized cells in order to spread out construction costs over time while balancing cost effectiveness. Cell size and sequencing has not yet been finalized, but the combined footprint would not exceed what is shown in Figure 4. The volume capacity of the CDF would be approximately 6,850,000 cubic yards, which would provide approximately 20 years of capacity assuming an annual dredging volume of about 338,220 cubic yards per year. The first cell would be constructed from 2012 through 2014, allowing filling operations to begin in 2015. Additional cells would follow, with each subsequent cell becoming operational as the previous cell is filled.

1.3 Authority and Purpose

1.3.1 This project is being proposed for construction under the Cleveland Harbor Operations and Maintenance (O&M) authority. This study is 100 percent Federally funded through the O&M program to continued maintenance of Congressionally authorized channel depths at the harbor and sufficient capacity for dredged material disposal for a minimum of 20 years. The study was conducted pursuant to existing authorities for individual navigation feasibility studies, Preconstruction Engineering and Design (PED) investigations, construction, or O&M, as provided in Congressional Committee study resolutions and public laws authorizing specific projects.

USACE-Buffalo District has completed a Dredged Material Management Plan (DMMP)/Environmental Impact Statement (EIS) that has formulated and evaluated a plan for maintenance dredging and the disposal of dredged materials from Cleveland Harbor through the year 2029.

1.3.2 The purpose of this Section 404(b)(1) Evaluation is to assess the water quality and associated impacts of constructing a CDF located at the East 55 Street site and the discharge of dredged contaminated material into that facility. This evaluation utilizes current USEPA Guidelines (40 CFR part 230) and considers placement of fill and dredged material. This evaluation also applies to Department of the Army permit applications for the placement of contaminated dredged material from areas adjacent to the Federal Channel into the proposed CDF.

1.4 General Description of Dredged and Fill Material

1.4.1 *General Characteristics of Material.*

1.4.1.1 CDF Walls. The perimeter walls would consist of both quarry-run stone rubblemound dikes (similar in construction to that of existing Dike 10B at Cleveland Harbor) and back-to-back open cell wall design. Since this site may be developed in the future by the local sponsor, the local sponsor has requested a vertical surface along the northern, eastern, and a portion of the western outer walls for possible areas for mooring vessels.

For the rubblemound portions of the East 55th Street site, typical stone cross-sections for the existing CDF at Dike 10B were assumed applicable to this site (Figure 5). It is assumed the phased construction would progress east to west.

The vertical wall system consists of parallel combi-walls (steel sheet pile and wide flange king piles) 60 feet apart anchored together near the top with double steel channel walls and threadbar tie rods. The space between the vertical walls is filled with granular fill and capped with a temporary concrete slab as protection against loss of fill from wave overtopping. The vertical wall system initially functions as a containment structure as the CDF is being filled with dredged material. The intent of the vertical walled cell is to reduce the footprint of the cell and its corresponding encroachment on the existing Federal channel. Inside the cell, the vertical walls maximize available disposal capacity in what is a relatively small disposal space.

This design is only suitable for cells inside the protected harbor, as they are not able to withstand the wave and ice action of the open lake water. The CDF is designed to contain the contaminated sediments through the use of a geotextile membrane, a thick filter layer, and limestone dike material construction.

Pumpout facilities would not be constructed or provided as part of the CDF construction.

The CDF overflow weir would be constructed with removable boards or slide weir to provide for an adjustable weir top elevation.

1.4.1.2 Dredged Material. The dredged material is comprised almost entirely of silts and clays and some sands.

1.4.2 *Quantity of Material.*

1.4.2.1 CDF Walls. Approximately 89,795 tons of “B” stone, 1,500,866 tons of “C” stone, 293,500 tons of “F” stone, 83,412 tons of “H” stone, and 972,500 tons of granular fill would be used to construct the proposed CDF dike. Approximately 1,424,447 square feet of steel sheet pile would be placed. The total of length of steel sheet pile incorporated into the cells would be 15,039 feet.

1.4.2.2 Dredged Material. Approximately 338,000 cubic yards of bottom sediments are dredged from Cleveland Harbor each year. The capacity of the CDF would be approximately 6,850,000 cubic yards. For the life of the CDF, the dredged material discharge rate into the site would be about 338,000 cubic yards per year.

1.4.3 *Source of Material.*

1.4.3.1 CDF Walls. Stone materials and manufactured steel products would be obtained from available commercial sources.

1.4.3.2 Dredged Material. Dredged material to be placed into the CDF would be obtained from the Cleveland Outer Harbor, the Old River Channel, the Cuyahoga River Channel, and some permitted adjacent channels. These sediments generally originate from upstream erosion throughout the Cuyahoga River watershed, including streambank and shoreline erosion. Channel bottom sediments are primarily bedload deposits laid down by the Cuyahoga River with some material deposited by littoral currents moving along the Lake Erie shoreline and around harbor navigation structures.

1.4.4 *Preliminary Evaluation of Dredged Material*

1.4.4.1 Sediment Quality Analyses. USACE-Buffalo District conducts sediment sampling at Cleveland Harbor every five years. Cleveland Harbor sediments (including Cuyahoga River Channels) were last sampled and analyzed by USACE-Buffalo District in 2007 under contract to Environment and Engineering Incorporated (EEI). Figures 11 - 16 show the sampling site locations. Sampling sites CH-1 through CH-22 represent the River Channels, CH-23 through CH-30 represent the Outer Harbor, and CL-1 through CL-4 represent the open-lake reference sediments (See USACE 2007). The sediment testing included analyses for inorganic parameters (metals, nutrients, total organic carbon [TOC], etc.), organic contaminants (Polychlorinated Biphenyls [PCBs], Pesticides, Polynuclear Aromatic Hydrocarbons [PAHs]) and elutriate analyses. The following is a summary of the test results:

a. *Particle Size Analysis*. The River Channel material was comprised of between 35.7% (Site CH-1) and 98.3 % (Site CH-13) silts and clays, with the remainder sands. The Upper End material within the River Channel was comprised of between 49.8% (Site CH-4) and 64.3% (Site CH-1) sands, with the remainder silts and clays. The Old River Channel material was composed of between 39.8% (Site CH-22) and 63.4% (Site CH-21) sands, with the remainder silts and clays. The Outer Harbor Channel material was comprised of between 90.9% (Site CH-30) and 99.1% (Site CH-27) silts and clays, with the remainder sands. Sediments at the open-lake reference area were comprised predominantly of silts and clays (98.3% [Site CL-4] to 98.9% [Site CL-2]), with a very small fraction of sands. Table 1 shows the results of the particle size analysis.

b. *Inorganic Analyses*. Relative to open-lake reference area levels, heavy metal concentrations in the Federal navigation channel sediments were generally comparable. Some sediment samples showed significantly elevated heavy metals concentrations when compared to those at the open-lake reference area. Arsenic concentrations at Sites CH-9, CH-12, CH-13, CH-14, CH-25 and CH-29, which range from 17.4 mg/kg to 20.3 mg/kg, may be of toxicological concern. At Site CH-6, the mercury concentration of 2.88 mg/kg could be acutely toxic. The lead concentration of 127 mg/kg at Site CH-22 would appear to be acutely toxic. Zinc concentrations at Sites CH-9, CH-13 and CH-17, which ranged from 379 mg/kg to 428 mg/kg, may be of toxicological concern. Based on these data, the following heavy metal COCs were identified: mercury at Site CH-6; arsenic and zinc at Site Ch-9 and CH-13; arsenic at Site CH-12, CH-14, CH-25, and CH-29; zinc at Site CH-17; and lead at Site CH-22. Tables 2 and 3 show the results of the inorganic analysis.

c. *TOC, Ammonia, and Cyanide*. TOC levels in the Federal navigation channel sediment samples ranged from 6,780 ppm (Site CH-22) to 40,000 ppm (Site CH-30). At the open-lake reference area, TOC concentrations ranged from 27,000 ppm (Site CL-4) to 30,600 ppm (Site CL-2). TOC levels at all sites, except for Sites CH-6, CH-7, CH-9, CH-10, CH-13, Ch-23 and CH-30, were significantly below the lowest open-lake reference area TOC level of 27,000 ppm. However, the sediment TOC in Cleveland Harbor exceeds the TOC limit of 5,000 ppm identified in the Ohio Department of Natural Resources (ODNR) and Ohio Environmental Protection Agency (OEPA) guidelines for sediment placement in the littoral system. With respect to other inorganic contaminants, ammonia levels at Sites CH-3, CH-10 and CH-25 (ranging from190 mg/kg to 201 mg/kg) may be toxicologically significant. With respect to cyanide, concentrations at Sites CH-21 and CH-22 (ranging from 2.62 mg/kg to 3.63 mg/kg) could be of toxicological concern. Based on these data, ammonia and cyanide were identified as contaminants of concern (COC) at the respective sites. Tables 2 and 3 show the results of the TOC, ammonia and cyanide analysis.

d. *Organic Analyses (PAHs)*. Total PAH concentrations in the Federal navigation channel sediments ranged from 1.13 mg/kg (Site CH-11) to 7.18 mg/kg (Site CH-6). Total PAH levels at the open-lake reference area were quite low, ranging from 0.03 mg/kg (Site CL-1) to 0.69 mg/kg (Site CL-

4). While total PAH concentrations at all of the Federal navigation channel sites exceeded those at the open-lake reference area, many may not be of significant toxicological concern. Nevertheless, given the TOC level throughout the Federal navigation channel sediments, and an assumed low fraction of black carbon, some PAH compounds may be more bioavailable and therefore capable of exerting acute toxicity. Tables 4 and 5 show the results of organic analysis.

e. *PCBs*. PCBs were measured at all of the Federal navigation channel sites; Aroclors 1242, 1254 and 1260 were predominantly detected. Quality Control (QC) checks were completed. Individual Aroclor mixtures that were detected ranged from 22.2 µg/kg of Aroclor 1254 at Site CH-8 to 260 µg/kg of Aroclor 1254 at Site CH-27_{QC}. "Total PCB" concentrations (the sum of the three predominant Aroclors, valuing non-detectable concentrations at the laboratory reporting limit [LRL]) in the Federal navigation channel sediments ranged from 96.6 µg/kg to 504 µg/kg at Sites CH-14 to CH-27_{QC}, respectively. Aroclor 1254 was the only PCB mixture detected in the open-lake reference area sediments, ranging in concentration from 35.4 µg/kg (Site CL-3) to 42.8 µg/kg (Site CL-2). Since Aroclor 1254 was the only detected PCB mixture, the measured level was assumed to represent the "total PCB" concentration. Total PCB concentrations at all of the Federal navigation channel sites exceeded those at the open-lake reference area sediments. Table 6 shows the results of the PCB analysis.

f. *Pesticides*. Most pesticides in the Federal navigation channel sediment samples were non-detectable at LRLs ranging from 1.02 µg/kg to 623 µg/kg. With the exception of dieldrin at Site CH-10 (11.6 µg/kg), 4,4'-dichlorodiphenyltrichloroethane (DDT) and its metabolites/breakdown products 4,4'-dichlorodiphenyldichloroethylene (DDE) and 4,4'-dichlorodiphenyldichloroethane (DDD) were detected at most of the Federal navigation channel sites. DDD was the only pesticide detected in the open-lake reference area sediments, ranging in concentration from 7.89 µg/kg to 8.95 µg/kg at Sites CL-1 and CL-2, respectively. Tables 7 and 8 show the results of pesticide analysis.

g. *Elutriate Testing*. The results showed releases of some heavy metals, ammonia and cyanide from the sediments (Table 3.10). Evidenced heavy metal releases from the harbor sediments were low, and maximum releases (dissolved) generally occurred from MUs CH-URMU and CH-LRMU sediments. The highest releases of copper and mercury (dissolved) were 1.5 µg/L and 0.0024 µg/L from MU CH-URMU sediments, respectively. Releases of PAH compounds (dissolved) were indicated at several of the Federal navigation channels sites (Table 5) Maximum benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, chrysene, fluoranthene and pyrene releases (dissolved) were 0.156 µg/L, 0.181 µg/L, 0.405 µg/L, 0.143 µg/L, 0.172 µg/L, 0.254 µg/L and 0.386 µg/L at MU CH-LRMU in the Lower River channel reach, respectively. With respect to PCBs, no releases (dissolved) were shown at LRLs ranging from 0.0102 µg/L to 0.104 µg/L (Table 3.12). Pesticide releases (dissolved) from the sediments were non-detectable at LRLs ranging from 0.0222 µg/L to 2.78 µg/L (Table 6).

The overall data results indicate that sediment within the Federal Channels fails to meet Federal Guidelines (specifically PAHs and heavy metals), and in accordance with joint USEPA/USACE protocols contained in the Great Lakes Dredged Material Testing and Evaluation Manual (1998), is unsuitable for open-lake and nearshore placement. Therefore, all dredged material would be placed in the proposed CDF.

1.4.4.2 <u>Potential Sources of Sediment Contamination</u>. The Cleveland Harbor vicinity had been and to a large degree remains a predominately urban and industrial area. Contaminants associated with bottom sediments at Cleveland Harbor originate from past and current industrial (e.g., steel-making, stone processing) and municipal discharges, stormwater runoff from impervious surfaces such as roads, parking lots, etc., residential sewage disposal systems, and runoff from agricultural lands.

1.5 Description of the Discharge Site

1.5.1 *Location.* The East 55th Street CDF site is located on Lake Erie at the eastern end of the Cleveland Harbor Approach and Entrance Channel (Figure 4). Toe the west, the site is bound by the East 55th Street marina's eastern breakwater. On the south, the site is bound by the natural shoreline near the terminus of East 55th Street. On the east, the site is bound by the existing First Energy circulating water intake.

1.5.2 *Size.* The site encompasses an area of approximately 157 acres.

1.5.3 *Type of Site*. The proposed CDF site is currently unconfined, albeit partially sheltered by the marina breakwater to the west, water intake to the east and the Cleveland Harbor East Breakwater (located approximately 2,500 feet lakeward.)

1.5.4 *Type of Habitat.* An underwater dive at the site was conducted by a USACE biologist in July 2008 at the CDF site to determine the general habitat characteristics of the area. Five transects were traversed by the biologist through the area in both the open water and nearshore portions of the site. The diver observed that the sediment layer throughout the project site consisted of a homogeneous layer of sandy loam mixed with crushed zebra (*Dreissena polymorpha)* and quagga mussel *(Dreissena rostriformis bugensis)* shells. Due to the homogenous and flat nature of the bottom substrate, it is not expected that any significant fish spawning beds occur at the site, and none were observed by the diver. Freshwater drum (*Aplodinotus grunniens*) and numerous exotic invasive round goby (*Neogobius melanostomus*) were observed during the dive throughout the proposed project area. A few small largemouth bass and yellow perch were observed near the nearshore areas containing submerged stone riprap. In general, no outstanding aquatic habitat was found at the project site. Recent fisheries surveys (1994 and 2002) conducted by the OEPA-Division of Surface Water Ecological Assessment Unit in the vicinity of the proposed project area indicated the primary species found, in terms of numbers, were pumpkinseed sunfish, rock bass, and largemouth bass.

1.5.5 *Timing and Duration of Discharge*. It is estimated that three construction seasons would be needed to complete installation of the stone and cellular steel sheetpile dikes for the CDF. Dredging and discharge of dredged material normally occurs over 3 to 4 months between May and September. Approximately 338,000 cubic yards of dredged material would be discharged into the CDF on an average annual basis. Discharges from the CDF's overflow weir would not occur until the facility has been nearly filled to capacity.

1.6 Description of the Discharge Method.

1.6.1 Construction of the stone rubblemound portions proposed CDF would be conducted by a private contractor under contract with the Corps of Engineers. It is anticipated that the contractor would utilize barges and a barge-mounted crane to construct the facility. Stone would be brought from the quarry to the barge-loading site by trucks or train and most likely placed onto barges by conveyor or land-based crane. The stone would then be transported over water to the project site. Smaller bedding, core, and filter stone would be placed by dumping, chute, or clamshell bucket, whereas the larger sized armor stone on the outside surfaces of the dike would be placed by the barge-mounted crane. The loss of fine material during construction is expected to be minimized by the fact that the stone placement would occur within a relatively protected area. An excessive loss of fine material would be further controlled by requiring the construction contractor to immediately place filter fabric and cover stone over the filter stone, along with restricting placement of filter stone to calm water periods in the harbor.

1.6.2 Construction of the steel bulkhead portions of the proposed CDF would be conducted by a private contractor under contract with the Corps of Engineers. Essentially, the sheet steel pile bulkheads consist of two continuous and parallel bulkheads placed approximately 60 feet apart and filled with virgin granular material. It is anticipated that the contractor would utilize land based construction equipment, barges, and a barge-mounted crane to construct the facility. Steel sheet pilings would be brought from mill to the barge-loading site by trucks or train and most likely placed onto barges by land-based crane. The steel sheet piles would then be transported over water to the project site. Smaller bedding and granular fill for the voids between the parallel sheet steel pile walls would be placed by dumping, chute, or clamshell bucket. The loss of fine material during construction is expected to be minimized by the fact that the stone placement will occur between two parallel sheet steel pile bulkheads.

1.6.3 During the past few decades, maintenance dredging in Federal navigation channels of Cleveland Harbor was accomplished by mechanical (i.e., clamshell bucket) means, although in the mid- to late 1970's, hopper dredges were also used. With regard to the discharge of dredged material into the completed CDF, such work would likely be accomplished either by use of a scow and clamshell bucket whereby the dredged material in the scow would be removed by the clamshell bucket and then deposited directly into the CDF, or by use of a scow and hydraulic pump, whereby dredged material would be pumped from the scow directly into the CDF via a pipeline. The current mode of operation requires the dredging contractor to provide the necessary equipment to transfer the dredged material from the transporting vessel to the CDF.

1.6.4 When the CDF is filled to approximately mean lake level +8 LWD, after dredged material is deposited in the CDF and allowed to settle, the dredged material supernatant would be discharged through the facility's overflow weir. CDF weir discharges are generally only utilized during the later use of the CDF, when the fill material reaches above lake level. Even during the middle stages of the life of the CDF, ponded water would not likely be released via evapotranspiration. The overflow weir discharge may also used to avoid undesirable conditions, such as a potential outbreak of avian botulism.

2. FACTUAL DETERMINATIONS

2.1 Physical Substrate Determinations.

2.1.1 *Substrate Elevation and Slope.* The proposed CDF site consists of a sloping lake bottom substrate that slopes from the shoreline lakeward to the U.S. harbor line and a depth of about 23 feet below LWD[1]. As the CDF is filled, the substrate within the CDF would be gradually be raised and converted to a more horizontal slope. The discharge of suspended solids (with the deployment of the overflow weir during the latter years of the life of the CDF) would result in negligible changes in substrate elevation and slope at the site.

2.1.2 *Sediment Type*. The CDF construction materials would replace the sandy loam and shell substrate with material with large armor stone, toe stone units (likely consisting of limestone), and steel sheet piles. Within the CDF, the existing substrate would be replaced by predominantly silt and clay, with some sandy material.

2.1.3 *Dredged/Fill Material Movement*. No significant movement of stone material used to construct the proposed CDF dikes is anticipated. Any movement of dredged material discharged into the CDF would be confined to the interior of the diked area. No movement of dredged material through the marina dike, water intake dike, or to-be-constructed cellular SSP dike is anticipated. As the area is filled, dredged material would spread throughout the remainder of the containment area and further settling would occur as the material is allowed to consolidate. During dredged material discharge, the CDF cells would serve as settling basins for the deposition of suspended sediments contained in the discharge supernatant. During the latter stages of CDF filling, suspended solids contained in the dredged material supernatant would be discharged into Lake Erie via the facility's overflow weir. After allowing for sufficient settling within the CDF, the total suspended solids concentration within the discharge would be limited to 100 ppm or less.

2.1.4 *Physical Effects on Benthos.* Stone placement and the construction of cellular steel sheet pile dike to construct the CDF would disrupt, displace and destroy existing benthic invertebrate organisms within the footprint of the facility. Some benthic organisms would be smothered during dike construction whereas others would be disrupted and displaced. Turbidity caused by disruption of the water column and substrate silt and detritus re-suspension would locally and temporarily aggravate breathing and feeding mechanisms of benthic life. As suspended sediments settle out, additional benthic organisms could also be smothered. Within the 157-acre CDF site, the annual discharge of dredged material would smother additional organisms. Surviving benthic organisms at the site and those contained within the dredged material would continue to re-colonize the interior of the CDF to some degree. With the eventual filling of the entire site, the CDF would be converted from aquatic to terrestrial habitat.

2.1.5 *Actions Taken to Minimize Impacts.* The recommended CDF utilizes, to the maximum extent practicable, existing structures (i.e., marina breakwater, water intake and shoreline) to minimize the construction of confining dikes. Overflow discharges from the CDF would be monitored and controlled to limit the release of total suspended solids to a maximum concentration of 100 ppm.

2.2 Water, Circulation, Fluctuation, and Salinity Determinations

2.2.1 *Water*

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[1] Low Water Datum in Lake Erie is 569.2 feet above mean sea level at Rimouski, Quebec, Canada (IGLD 85).

a. Salinity. Not applicable.

b. Water Chemistry. CDF construction would not significantly alter the pH of the receiving waters. The discharge of dredged material into the CDF would also not significantly alter pH or water temperature. However, with reduced circulation and water volume within the CDF, water temperatures would be subject to more rapid seasonal fluctuations.

c. Clarity. The re-suspension of bottom sediments during dike construction and dredged material discharges would cause temporary localized increased turbidity that would contribute to a short-term reduction in water clarity, until materials in suspension settle out and ambient conditions return. The discharge of effluent via the facility's overflow weir would temporarily increase turbidity, mainly within the mixing zone near the CDF.

d. Color. Water color in the vicinity of the project site is normally turbid and dark in color. During the period of dike construction, the water column would temporarily be altered to a darker color as bottom sediments become re-suspended into the water column. During dredged material discharges, changes in water color would be restricted to the interior of the proposed CDF.

e. Odor. No significant disagreeable odor would be anticipated during dike construction. Some localized temporary adverse odor may occur as dredged material is discharged into the CDF site.

f. Taste. No significant alteration in water taste would be anticipated by dike construction. Although deterioration in taste from ambient conditions would likely occur in water within the CDF during periods of dredged material discharge, this area is not a source of drinking water.

g. Dissolved Gas Levels. No effect as a result of dike construction. Some temporary alteration in dissolved gas levels (i.e., dissolved oxygen) would occur within the CDF as a result of decreased water circulation and the discharge of dredged material.

h. Nutrients. No effect as a result of dike construction. A decrease in dissolved gas levels (i.e., dissolved oxygen) would occur within the CDF as a result of decreased water circulation and the discharge of dredged material.

i. Eutrophication. No effect as a result of dike construction. Although eutrophication would probably be accelerated or altered to some degree within the CDF by significantly reduced water circulation and the discharge of dredged material, no increase in eutrophication in water outside the CDF is expected. Reductions in circulation may result in an excessive build-up of bacteria, thereby impacting human health for users of the water resource. However, the modeling results for the proposed CDF showed that the proposed CDF should not cause eutrophication as there is not an excessive build-up or concentration of neutrally buoyant and negatively buoyant particles (USACE 2008).

2.2.2 *Current Patterns and Circulation*

a. Current Patterns and Flow. A two-dimensional, depth-averaged, version of the hydrodynamic advanced circulation (ADCIRC) model was applied in this study (USACE 2008). Potential adverse impacts due to the proposed CDF were determined by examining changes in model-generated current circulation and thermal transport patterns. ADCIRC modeling efforts concentrated on quantifying the change in circulation patterns with and without the CDF in place for storm and quiescent/non-storm conditions. This model required grid development and calibration/validation of the bathymetric grid to wind forcing. For the model calibration and validation, ADCIRC results were compared with 12 National Ocean Service (NOS) water level gauges throughout Lake Erie and the Comprehensive Mapping and Engineering Data System (CMEDS). The calculated water levels from the ADCIRC simulation compared well in range and phase with the NOS gauge measurements considering that the locations of the eastern gauges were well outside the area of high resolution in the project area. Under easterly wind conditions, the proposed CDF would increase peak storm-induced westerly currents within the channel from about 0.05 meters per second (m/s) to approximately 0.4 m/s. The stronger currents induced by the planned CDF is attributed to the reduced cross-sectional area within the channel. (Figures 7 through 10)

Currents at the East 55th Street Marina entrance were characterized as weak. A change in current strength at the marina was attributed to sheltering caused by the planned dike configurations. Circulation modeling also indicated minimal impacts to water circulation near the proposed CDF site when compared to Without Project Conditions (Figure 9). In fact, the normally channelized flow running lateral to the shoreline and along the deeper Federal channel seemed to be accelerated by the in-place project condition. This is to be expected, as the CDF would slightly reduce channel size, which naturally accelerates flow. Additionally, the slight projection of the CDF into the natural channel would cause some flow to “catch” on the northwest corner of the CDF and redirect to the south, creating a circular and active flow (Figure 10). This phenomenon is best attributed to a cavitational flow condition created by the projection of the proposed CDF and the harbor “cavity” created between the existing CDF 12 and the proposed CDF.

The proposed CDF would have no impact to the combined sewer overflow discharges; impacts are limited to the effects of changes of the receiving waters, primarily potential circulation and volume changes. Reductions in circulation sometimes result in an excessive build-up of bacteria, thereby impacting human health for users of the water resource. However, the modeling results showed that the proposed CDF should not cause eutrophication as there is not an excessive build-up or concentration of neutrally buoyant and negatively buoyant particles.

b. Velocity. As stated above, the model study indicated accelerated water velocity as a result of the slight reduction in channel size.

c. Stratification. No significant effect.

d. Hydrologic Regime. No significant effect.

2.2.3 *Normal Water Level Fluctuations*. No significant impact on normal water level fluctuations is anticipated.

2.2.4 *Salinity Gradients*. Not applicable.

2.2.5 *Actions Taken to Minimize Impacts.* A consideration in the selection of the proposed CDF site was that it would have minimal disruptions to existing current patterns and flows.

2.3 Suspended Particulate/Turbidity Determinations

2.3.1 *Expected Changes in Suspended Particulates and Turbidity in the Vicinity of the Discharge Site.* The re-suspension of bottom sediments during dike construction and dredged material discharges would cause temporary localized increased turbidity that would contribute to a short-term reduction in water clarity, until materials in suspension settle out and ambient conditions return. The discharge of effluent via the facility's overflow weir would temporarily increase turbidity, mainly within the mixing zone adjacent to the CDF.

2.3.2 *Effects on Chemical and Physical Properties of the Water Column.*

a. Light Penetration. Temporary decreases in light penetration would occur during dredged material discharges into the CDF and, to a lesser extent, during dike construction. Discharges from the CDF's overflow weir would result in minimal decreases in light penetration.

b. Dissolved Oxygen. Temporary decreases in dissolved oxygen would occur during dredged material discharges into the CDF and, to a lesser extent, during dike construction. Discharges from the CDF's overflow weir would result in minimal decreases in light penetration.

c. Toxic Metals and Organics. Two major processes occur when dredged material is placed in the CDF to separate sediments and associated adsorbed pollutants (most pollutants are adsorbed to sediment particulate) from the water: (1) Sediments and pollutants are filtered out while some effluent passes through the dike wall and (2) sediments and pollutants settle out from the ponded water column; after which the relatively clean water is left to evaporate or is decanted from the CDF through the CDF discharge control weir. No significant releases of toxic metals, organics, and pathogens are expected from the CDF.

d. Pathogens. Avian botulism is due to the ingestion of a toxin produced by the bacteria *Clostridium botulinum*. Botulism can become a concern at CDFs when dredged material forms shallow ponds or is raised slightly above water. These shallow ponded areas can provide an attractive food source for waterfowl. When the conditions necessary for bacterial growth occur in CDFs, the potential for a botulism outbreak and bird mortality can be established (USEPA. 1994).

e. Aesthetics. The operation of construction and dredging equipment during CDF construction and subsequent dredged material discharge operations would result the temporary increased turbidity, noise, fumes, odors, dust and short-term degradation in the aesthetic qualities of Cleveland Harbor and Lake Erie at the CDF site. Construction of the CDF dike would permanently add a new structure at the waterfront and add to the developed man-made appearance at the East 55th Street site.

2.3.3 *Effects on Biota.*

a. Primary Production. Construction of the proposed CDF adversely effect and eventually eliminate the aquatic habitat functions of the site. Short-term increases in turbidity and decreases in sunlight penetration during construction of the CDF would likely cause some localized decrease in primary production of plankton. Ultimately, the CDF would be completed filled with dredged material and converted to terrestrial habitat.

b. Photosynthesis. Short-term increases in turbidity and decreases in sunlight penetration during construction of the CDF would likely cause some localized decrease in photosynthesis.

c. Suspension/Filter Feeders. Turbidity increase resulting from CDF construction activities temporarily aggravate breathing and filtration mechanisms of suspension and filter feeders.

d. Sight Feeders. Due to increased turbidity, some short-term adverse impact on finding prey by sight feeders may occur in the general vicinity of the project site. However, many sight feeders would probably tend to avoid aquatic habitat in the immediate vicinity of construction, until work ceased and turbidity subsided.

2.3.4 *Actions Taken to Minimize Impacts.*

In order to help minimize adverse impacts on aquatic biota, the contractor would be required to complete the project within three construction seasons.

In accordance with Corps of Engineers Civil Works Construction Guide Specification for "Environmental Protection" (USACE 1970), the construction contractor and dredging contractor would be required to minimize the potential for accidental spillage of fuel, oil, and/or grease.

The operation of the CDF would be conducted in a manner that would maximize retention of dredged material within the facility, thereby limiting the movement of suspended sediment over the weir into the harbor and lake. Maximum retention of suspended particulates would be accomplished in two ways. First, the CDF weir would be constructed with removable boards. In this way, sufficient retention times and ponding depths would be provided to ensure a weir effluent total suspended solids concentrations no greater than 100 ppm for the mid- to final years of operation. In the final year of operation of the CDF, the suspended solids level is expected to remain below 100 ppm. Sporadic use of the CDF by large vessels from the outer harbor discharging at higher rates would be regulated to provide an acceptable effluent quality.

Because botulism occurs in mud flats and shallow ponded areas, a preventive strategy for botulism could be part of the CDF's water management program. Proper placement of dredged material and drainage of the CDF through the overflow weir would help prevent the development of extensive mud flats and ponded areas. A second approach for the prevention of botulism would be to schedule the dredging/disposal operations during the cooler seasons. If mud flats or ponded areas develop during these cooler seasons, the potential for a botulism outbreak is minimized because of the inhibition of toxin production by cooler temperatures.

If a botulism outbreak occurs, every possible effort must be made to control its spread. Limitation of the spread of botulism can be implemented by attempting to eliminate the toxin production and by making the site unattractive to waterfowl. This can be accomplished using short-term and long-term methods. Short-term methods include making the site unattractive using noisemakers, power boats in the area, or imitation predators. The removal of bird carcasses from the affected areas is also a necessary short-term action to eliminate toxin production.

At a nearby CDF (Dike 14), the Corps of Engineers implemented a pilot project, wherein plant materials were installed prior to the discharge operations so that a vegetative cover would rapidly appear as the CDF dewatered. The specific vegetation on the dewatering dredged material was selected to make the CDF unattractive to shorebirds, wading birds, and waterfowl susceptible to avian botulism.

Long-term methods involve changing the environmental conditions to eliminate the toxin production. Flooding the site with about 30 cm of water or draining the site to allow the dredged material to dry would eliminate shallow ponded areas. Drainage of shallow pond areas is an effective technique that can be accomplished by using pumps and/or constructing trenches.

2.4 Contaminant Determinations

2.4.1 The term "contaminant" is defined by USEPA Guidelines 40 CFR 230.3 (e) as "a chemical or biological substance in a form that can be incorporated into, onto, or be ingested by and that harms aquatic organisms, consumers of aquatic organisms, or users of the aquatic environment, and includes but is not limited to the substances on the 307(a)(l) list of toxic contaminants."

2.4.2 The material to be placed into the waters of Lake Erie to construct the CDF dikes would consist of clean quarry-run stone and manufactured steel sheet piles. Similar materials would be utilized to maintain the dikes, if such maintenance is needed in the future. The fill stone meets exclusion criteria for testing the chemical-biological interactive effects - outlined in 40 CFR 230.4 - 1(b), (2), and (3), and no testing on this material will be conducted. Such material may be excluded from the aforementioned testing if any of the exclusion criteria as defined in 40 CFR 23O.4-l(b)(i), (ii), or (iii) are met. Briefly stated, these exclusion criteria are: (i) that the dredged or fill material is composed predominately of sand, gravel, or other naturally occurring sedimentary material with particle sizes larger than silt, usually found in high energy environments; (ii) that the material is suitable and being used for beach nourishment; (iii) that the material proposed for discharge is primarily the same as at the proposed discharge site. This final criteria requires that the material proposed for discharge is sufficiently removed from sources of contamination to provide reasonable assurances that the material is not contaminated from such sources, and that adequate conditions are provided on the placement method to provide reasonable assurance that the placement material will not be moved by currents or otherwise in a manner that is damaging to the environment outside the disposal area. The stone fill proposed for placement below the ordinary high water mark at the CDF site is considered to be non-contaminated.

2.4.3 A discussion of contaminant levels of the dredged material be placed into the proposed CDF is included in Section 1.4.4 of this evaluation.

2.5 Aquatic Ecosystem and Organism Determinations

2.5.1 *Effects on Plankton.* During operation of the CDF, populations of phytoplankton and zooplankton within the facility would be cyclic, due to the influence of the annual discharge of dredged material. Eventually, all habitat for plankton within the CDF would be eliminated when the site is completely filled and converted from an aquatic to a terrestrial environment.

2.5.2 *Effects on Benthos.* Construction of the CDF and subsequent discharge of dredged material into the facility would result in the destruction of benthic organisms inhabiting the substrate at the project site. An area of approximately 157 acres of lake bottom would be covered by dredged material. Although the dredged material would continue to provide habitat for re-colonization by surviving organisms, eventually suitable habitat for these organisms would be destroyed when the site is completely filled and is converted from an aquatic to a terrestrial environment. The submerged dike slopes and toe stone along the steel sheet pile cells would continue to provide long-term habitat for benthic invertebrate colonization. Submerged stone would provide habitat for colonization by nuisance species, such as zebra mussels. (See Section 1.5.4)

2.5.3 *Effects on Nekton*. Turbidity during CDF construction may temporarily aggravate gill systems of fish in the general vicinity of the project site and cause fish to temporarily avoid the water column zone being disrupted by active construction. CDF construction and the subsequent discharge of dredged material would eliminate approximately 157 acres of lacustrine habitat for fish, including the entire overlying water column. The submerged stone along the CDF dikes would help diversify aquatic habitat and continue to provide long-term feeding and cover habitat for local fish species.

2.5.4 *Effects on the Aquatic Food Web*. Eventual elimination of aquatic habitat associated with the construction of the proposed CDF would contribute to a reduction in planktonic and benthic production that would reduce the amount of available food sources for local fish species. Except for waterfowl, terns and gulls that would likely utilize the CDF, aquatic biota within the CDF would be isolated from the aquatic food web in Lake Erie. Relatively rapid colonization of the submerged stone along the CDF dikes by algae and benthic organisms is anticipated, which would help replace some of the food chain organisms lost by the construction of the facility. If zebra mussels proliferate along the submerged stone surfaces, there may be an adverse impact on warmwater fish spawning along such habitat. However, zebra mussels may provide food for some species of diving ducks and warmwater fish (i.e., freshwater drum).

2.5.5 *Effects on Special Aquatic Sites.*

a. Sanctuaries and Refuges. No effect.

b. Wetlands. No significant effect.

c. Mud Flats. No effect.

d. Coral Reefs. Not applicable.

e. Riffle and Pool Complexes. No effect.

2.5.6 *Threatened and Endangered Species*. No effect.

2.5.7 *Other Wildlife*. The proposed CDF is located in a heavily industrialized/ commercialized area and is located at the foot of East 55th Street. As dredged material begins to fill the CDF to a point where fill material is protruding above the waterline, the temporary exposed damp mudflats may attract foraging shorebirds and possibly result in some temporary seasonal increased use by gulls, until the CDF becomes entirely filled, becomes better drained and dense natural vegetation establishes over the area. Annual discharges of dredged material into the CDF would progressively decrease the amount of open-water habitat availability for use by aquatic birds (i.e., gulls, terns, waterfowl). Once the site reverts to entirely terrestrial habitat and becomes invaded by natural woody and herbaceous vegetation, upland wildlife (such as cottontail rabbits, squirrels and other rodents, as well as ring-necked pheasants and songbirds) would likely be attracted to the nesting, brooding and feeding habitat that established on site.

2.5.8 *Actions Taken to Minimize Impacts*.

a. The proposed CDF would allow the continued dredging and confinement of contaminated sediments from Cleveland Harbor and permitted adjacent channels, thereby contributing towards reduced degradation of the Cuyahoga River and Lake Erie aquatic ecosystem.

b. Discharge effluent from the CDF would be managed to reduce the release of total suspended solids concentrations to 100 ppm or less.

c. The predictability of a future avian botulism outbreak at the CDF is uncertain due to variables such as weather, lake level, future dredging/discharge volumes, and other unknown or little understood environmental factors. However, some precautionary strategies would be taken to help prevent or minimize the likelihood or intensity of an occurrence of avian botulism. Inspections of the CDF would be made periodically between June 15 and September 15. Between June 15 and August 1, such inspections would be made at least once every two weeks. During the most critical period - approximately August 1 through October 31 - inspections would be made at least once per week. If dead or sick waterfowl or shorebirds are found in the facility, the following actions would be immediately taken:

(1) USACE field personnel would contact the USACE-Buffalo District office who would contact the U.S. Fish and Wildlife Service's Ecological Services Office and ODNR field representative;

(2) USACE field personnel would bury all carcasses immediately, or place carcasses in plastic bags for prompt removal from the site to an approved disposal area; sick birds collected would be given water and provided to the ODNR field representative for determination as to whether or not botulism is present in the affected bird.

If botulism is found to be a recurring problem, either a stable water level over the entire CDF could be maintained or the dredged material discharge pattern could be adapted to help minimize ponding. If needed, dredged material exposed above the waterline could be planted with herbaceous plant species to make these areas less attractive to wading birds and waterfowl. Covering the exposed dredged sediment with a grass mixture may also assist to some degree in dewatering such material.

2.6 Proposed Discharge Site Determinations

2.6.1 *Mixing Zone Determination.* The mixing zone for the CDF project discharge should generally be considered to be the discharge area within the containment dike. The facility would be operated in a manner that would maximize the retention of the particulate and pollutant matter within the CDF. The following factors were considered in determining the acceptability of the mixing zone as required by USEPA Guidelines: water depth; current velocity, direction, and variability; degree of turbulence; stratification, discharge vessel; rate of discharge; ambient concentration of constituents and dredged material characteristics; number of discharge actions per unit time; and other factors affecting rates and pattern of mixing.

a. Water Depth. The average existing depth at the CDF site is 22 feet below LWD. The final dredge fill elevation would be 8 feet above LWD.

b. Current Velocity, Direction, and Variability. Currents at the East 55th Street Marina entrance are characterized as weak and the planned configuration does not appear to have an appreciable impact on current strength in the marina.

c. Degree of Turbulence. Due to the protected nature of the CDF site, there is generally a low degree of turbulence at the site.

d. Stratification. Not Applicable

e. Discharge Vessel. Construction equipment and dredging vessels would be stationary during CDF construction and subsequent discharges of dredged material.

f. Rate of Discharge. Due to the very weak soils at the proposed site, stability considerations will limit the combi-wall crest elevation to 10 feet above Low Water Datum (LWD) despite the sheet pile being driven to 80 feet below LWD. To form the combi-walls, two parallel rows of wide flange 40x215 sections interspaced with PZC 13 steel sheet pile will be driven and tied together near the top using a wale system. The interior distance between the walls will be 60 feet and the area between the walls will be filled with a granular material and capped with a one-foot concrete paving.

Dike stone would be discharged at the approximate rate of 1,630 tons per day. The rate of discharge of dredged material into the CDF would be up to 3,000 to 6,000 cubic yards per hour. Once the ponded water level within the CDF reaches the level of the overflow weir, the rate of effluent discharge from the CDF into the harbor would be about 20 to 40 cubic yards per second during disposal operations.

g. Dredged Material Characteristics. See Section 1.4.4

h. Number of Discharge Actions per Unit Time. The sheet steel pile bulkheads consist of two continuous and parallel bulkheads placed approximately 60 feet apart and filled with virgin granular material. Approximately 1,424,447 square feet of steel sheet pile would be placed in order to construct the CDF. The total of length of steel sheet pile incorporated into the cells would be 15,039 feet. In order to place dike stone, it is estimated about 250 stone deposition actions may occur during the first construction season; 300 stone deposition actions during the second construction season, and about 300 stone deposition actions during the third construction season.

With regard to the placement of dredged material into the completed CDF, the number of discharge actions would be variable depending on transport times, dredging conditions and equipment used. The number of weir effluent discharges into the harbor per unit time would be equal to or less than the number of dredged material discharge actions and dependent on ponded water levels in the CDF.

2.6.2 *Determination of Compliance with Applicable Water Quality Standards.*

2.6.2.1 Ohio Environmental Protection Agency (OEPA) water quality standards for the proposed work areas are described in Chapter 3745-1 of the Ohio Administrative Code. Use designation includes Exceptional Warm Water Habitat, Bathing Water, and State Resource Water.

2.6.2.2 Deposition of relatively inert non-polluted stone and filter material to construct the CDF dike would not significantly alter the physical and chemical characteristics of the receiving water of the lake. See Sections 2.6.3 and 3.4.2.

2.6.2.3 Elutriate testing results showed releases of some heavy metals, ammonia and cyanide from the sediments (Table 9). Evidenced heavy metal releases from the harbor sediments were low, and maximum releases (dissolved) generally occurred from MUs CH-URMU and CH-LRMU sediments. The highest releases of copper and mercury (dissolved) were 1.5 µg/L and 0.0024 µg/L from MU CH-URMU sediments, respectively. Releases of PAH compounds (dissolved) were indicated at several of the Federal navigation channels sites (Table 10). Maximum benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, chrysene, fluoranthene and pyrene releases (dissolved) were 0.156 µg/L, 0.181 µg/L, 0.405 µg/L, 0.143 µg/L, 0.172 µg/L, 0.254 µg/L and 0.386 µg/L at MU CH-LRMU in the Lower River channel reach, respectively. With respect to PCBs, no releases (dissolved) were shown at LRLs ranging from 0.0102 µg/L to 0.104 µg/L (Table 11). Pesticide releases (dissolved) from the sediments were non-detectable at LRLs ranging from 0.0222 µg/L to 2.78 µg/L (Table 12).

2.6.2.4 Turbidity increases would unavoidably occur during CDF construction through the re-suspension of bottom sediments and within the facility as a result of subsequent discharges of dredged material. During dredged material discharge, compliance with water quality standards would not be expected within the CDF. The mixing zone for the discharge into the CDF should generally be considered the entire area within the containment dikes.

2.6.2.5 Total suspended solids concentrations in any effluent discharged from the CDF's overflow weir would be no greater than 100 ppm. Depending on a number of variables, it would generally take from one to several days for suspended solids to settle out from the supernatant within the CDF to reach this concentration. It is anticipated that a mixing zone distance of 1,000 feet would be required to reduce the concentrations to ambient levels. While there is no State water quality standard for total suspended solid discharges, the limit of 100 ppm would not violate any standards outside the mixing zone and would result in negligible additions of pollutants to Lake Erie over the 3 to 4 months that dredging normally occurs. Monitoring of the weir effluent would continue periodically to determine future if adjustments are needed for the use of the overflow weir.

2.6.9 *Potential Effects on Human Use Characteristics.*

a. Municipal and Private Water Supply. There will be no effect on municipal and private water supply as part of the construction of this project.

b. Recreational and Commercial Fisheries. Due to the CDF's connection to shore, waterfront land use is affected. Impacted community assets include 2,200 linear feet of shoreline fishing comprised of 1,900 linear feet of sheet steel pile bulkhead and 300 feet of large-stone rubblemound dike that forms the guidewall for the First Energy water circulation system intake structure. This loss of shoreline access may adversely affect property values and diminish community cohesion that results from recreational and social activities on the waterfront. It is also believed that much of the fishing conducted from the First Energy intake platform is for sustenance.

c. Water-Related Recreation. No effect.

d. Aesthetics. The operation of construction and dredging equipment during CDF construction and subsequent dredged material discharge operations would result the temporary increased turbidity, noise, fumes, odors, dust and short-term degradation in the aesthetic qualities of Cleveland Harbor and Lake Erie at the CDF site. Construction of the CDF dike would permanently add a new structure at the waterfront and add to the developed man-made appearance at the East 55th Street site. The CDF development is consistent with the City of Cleveland waterfront development plans.

e. Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, Or Similar Preserves. No effect.

2.7 Determination of Cumulative Effects on the Aquatic Ecosystem.

2.7.1 CDF construction and the subsequent discharge of dredged material at the site would add to continued encroachment on the aquatic environment in the coastal zone waters of Lake Erie and, would cumulatively add to the amount of aquatic habitat that has been converted to terrestrial habitat in the lake.

2.7.2 The construction of a suitable site for the confinement of polluted dredged material would allow the continued maintenance and operation of Cleveland Harbor and preserve its importance to the local and regional economies. The continued removal of these bottom sediments from the harbor would contribute towards a reduction in the degradation of the Cuyahoga River-Lake Erie aquatic ecosystem.

2.8 Determination of Secondary Effects on the Aquatic Environment

2.8.1 Construction of the proposed CDF would enable continued dredging and confined disposal of polluted and not suitable for unrestricted open-lake discharge harbor/river sediments, thereby contributing toward improvement of aquatic substrate quality in the River.

2.8.2 After the proposed CDF has been filled to capacity, the operation and maintenance of the facility would be transferred to the City of Cleveland. The ultimate development of the site would be the prerogative of the City of Cleveland subject to approval by the Corps of Engineers.

FINDING OF COMPLIANCE

CLEVELAND HARBOR
OPERATIONS & MAINTENANCE
(DREDGED MATERIAL MANAGEMENT PLAN - EAST 55th STREET CDF)
CUYAHOGA COUNTY, OHIO

1. No significant adaptations of the USEPA Guidelines were made relative to this evaluation.

2. Several alternatives were evaluated during the development of the recommended plan for the proposed CDF. Based on engineering, economic, environmental, and social considerations, the construction of a new CDF at the proposed site at the East 55th Street site was identified as the preferable alternative.

3. The planned discharges of dredged and fill material would not violate State water quality standards outside the designated mixing zone. The discharge of dredged and fill material would not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

4. The proposed discharge site would not jeopardize the continued existence of any species listed as endangered or threatened under the Endangered Species Act of 1973, as amended, or result in the likelihood of the destruction or adverse modification of their critical habitat.,

5. The proposed placement of dredged and fill would not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. Significant adverse effects on the life stages of aquatic wildlife or other wildlife would not be anticipated. No significant adverse effects on aquatic ecosystem diversity, productivity and stability, or recreational, aesthetic and economic values would occur.

6. Although habitat throughout Cleveland Harbor is generally of low quality, construction of a CDF will result in some habitat losses. As a result, mitigation measures will be included as part of the selected plan. In a Fish and Wildlife Coordination Act Report dated April 2007, USFWS provided a number of recommendations for mitigation that could be implemented to help to offset the loss of aquatic habitat. Based on these recommendations, the Corps will implement the following mitigation measures:

- Maximizing the use of existing CDF's.
- Take necessary actions during maintenance dredging to minimize impacts to water quality in the harbor.
- Fully implement BMPs during construction of the new CDF to maximize capacity.
- Coordinate with USFWS to meet seasonal restrictions on dredging to minimize impacts on fish spawning.
- If possible, manage the CDF for wildlife during periods of non-activity or after filling. However, this would be limited at the East 55th Street site due to concerns regarding collisions between birds and aircrafts.

- Encourage local landowners and municipalities to implement BMPs to minimize the volume of eroded materials entering Cleveland Harbor.
- Include fish spawning habitat along the outside of new and existing CDFs.

Of the recommendations provided by USFWS, the measure that will best mitigate for the aquatic habitat losses is the construction of fish habitat along the outside of CDF dikes. While a number of options exist for providing habitat, the presence of invasive species in Cleveland Harbor suggests that efforts should focus on vegetative rather than rocky habitat. Rocky habitat is more likely attract zebra mussel. Instead, "fish hotels" and/or habitat baskets which focus on providing vegetative cover and food would be a more appropriate measure as they would provide habitat that for native fish species rather than exotics such as the goby. These fish hotels have been constructed along the Chicago River in Illinois and have provided good results. A typical fish hotel would consist of:

- A floating structure with native aquatic plants on the surface to attract insects for fish to eat.
- A submerged level with more wetland plants for shelter.
- Several deeper fish cribs, where bigger fish can linger and hide.
- Typical dimensions may be 10 feet by 50 feet with depths around 9 feet.

Habitat baskets have been implemented along the lower 5.5 miles of the Cuyahoga River to provide viable habitat that supports larval fish and adults as they migrate through the river to and from Lake Erie. A habitat basket is designed to fit in the recesses of corrugated steel sheet pile. Each basket holds a plant pillow that can hold a variety of wetland plants. The mesh plant pillow prevents carp and geese from eating the plant seeds and roots.

A number of these structures could be placed throughout the harbor. Although the exact design and placement of the hotels and/or baskets will be developed in conjunction with ODNR, USFWS, and the City of Cleveland during the design phase of the study, it is anticipated that they will attract all of the species currently found in the harbor, and would also attract those fish species found at the site just outside of the harbor. These increases will occur due to fish being attracted to the new spawning/resting areas and predator fish that would be attracted to feed on these fish. As a result, the richness values (r) for those areas of the harbor which contain the hotels/baskets would be 1 (28/28). Although the actual size of the fish hotels is relatively small (~500 square feet each), they may serve to increase the richness factor not only within the hotel, but within the immediate vicinity. Habitat baskets provide 1.5 cubic feet of habitat and may also increase the richness value of the area. As a result, it is anticipated that construction of several (less than 10) fish hotels and installing multiple habitat baskets may provide enough high quality habitat to provide sufficient habitat units to justify the loss of poor habitat due to CDF construction. Based on the hotels used in the Chicago River Project, estimated cost for the hotels is approximately $50,000 each. Therefore, each alternative plan has a $500,000 mitigation component included in the cost estimates and economic analysis. Habitat baskets cost approximately $300 each, including installation.

7. On the basis of the Guidelines, the proposed CDF is specified as complying with the requirements of these Guidelines, with the inclusion of appropriate and practical conditions to minimize pollution and adverse effects on the aquatic ecosystem.

REFERENCES

USACE 1970, Civil Works Construction Guide Specifications for Environmental Protection. No. CE 1300. Washington: U.S. Government Printing Office.

USACE 2007, Project Report Chemical, Biological and Physical Testing for Sediment Samples Collected at Cleveland Harbor, Ohio.

USACE 2008, Cleveland Harbor Ohio Thermal Plume Transport Investigation.

USEPA 1994, ARCS Remediation Guidance Document.

Figure 1. Cleveland Vicinity Map

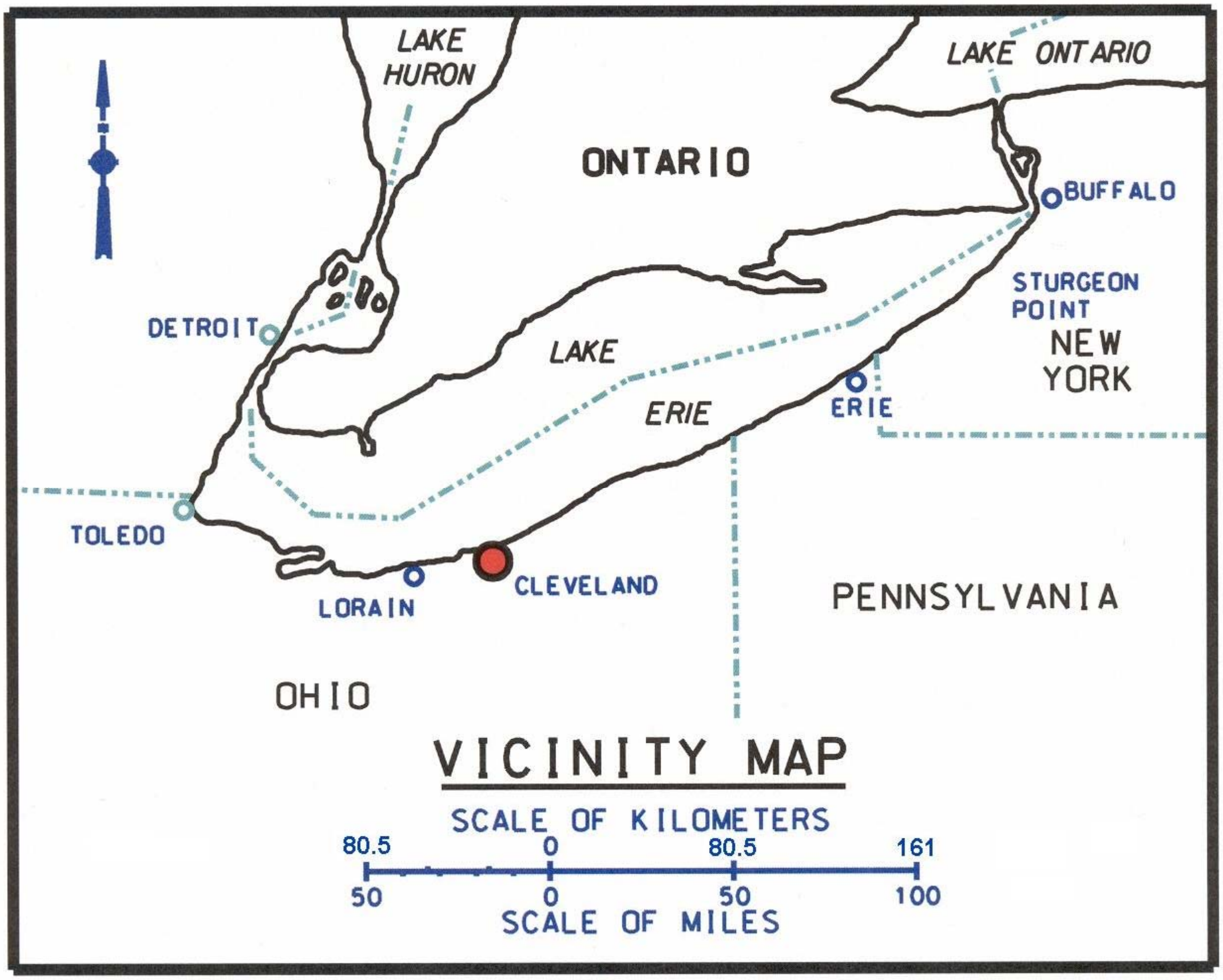


Figure 2: Cleveland Outer Harbor

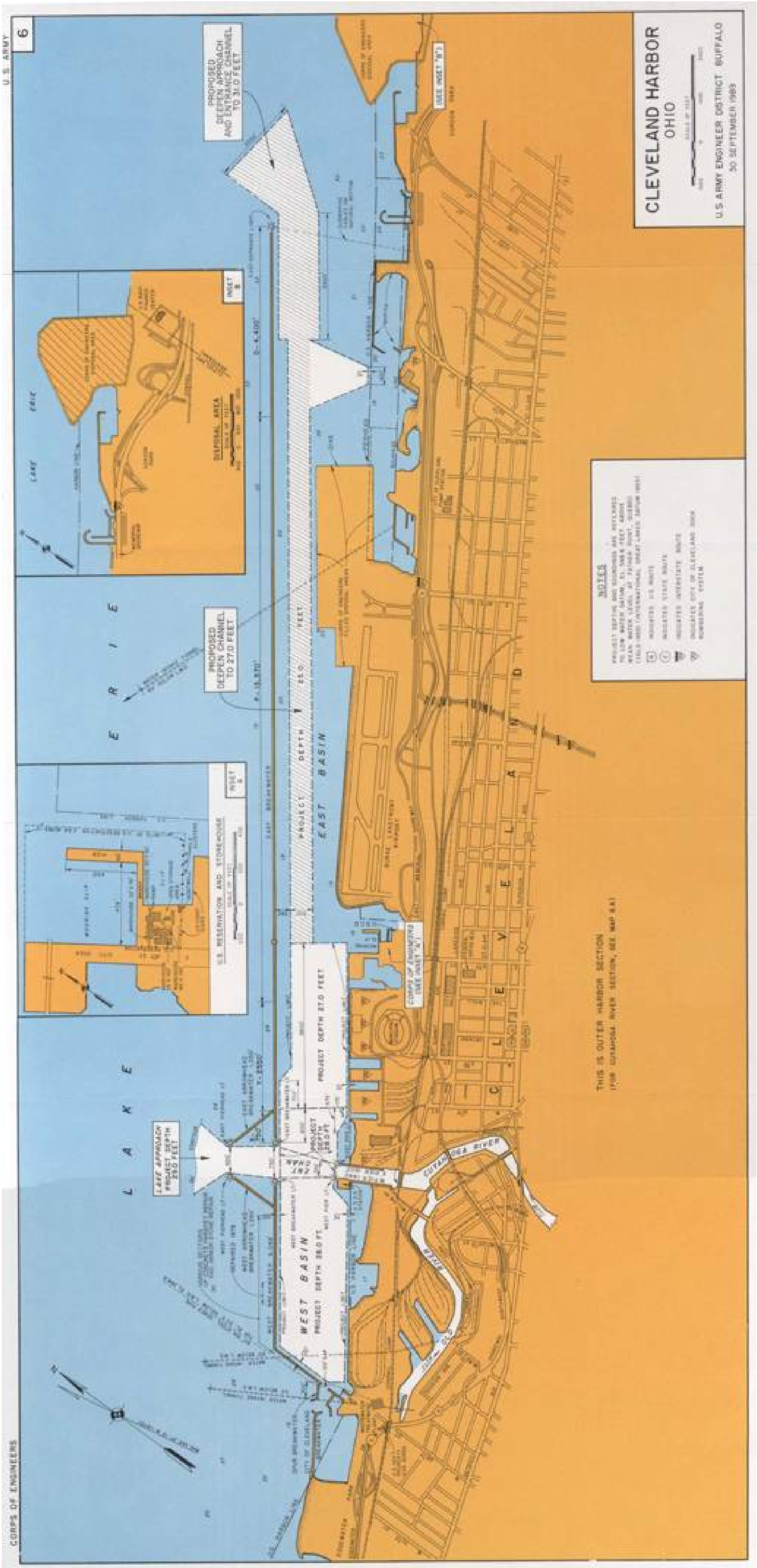


Figure 3. Cleveland Inner Harbor

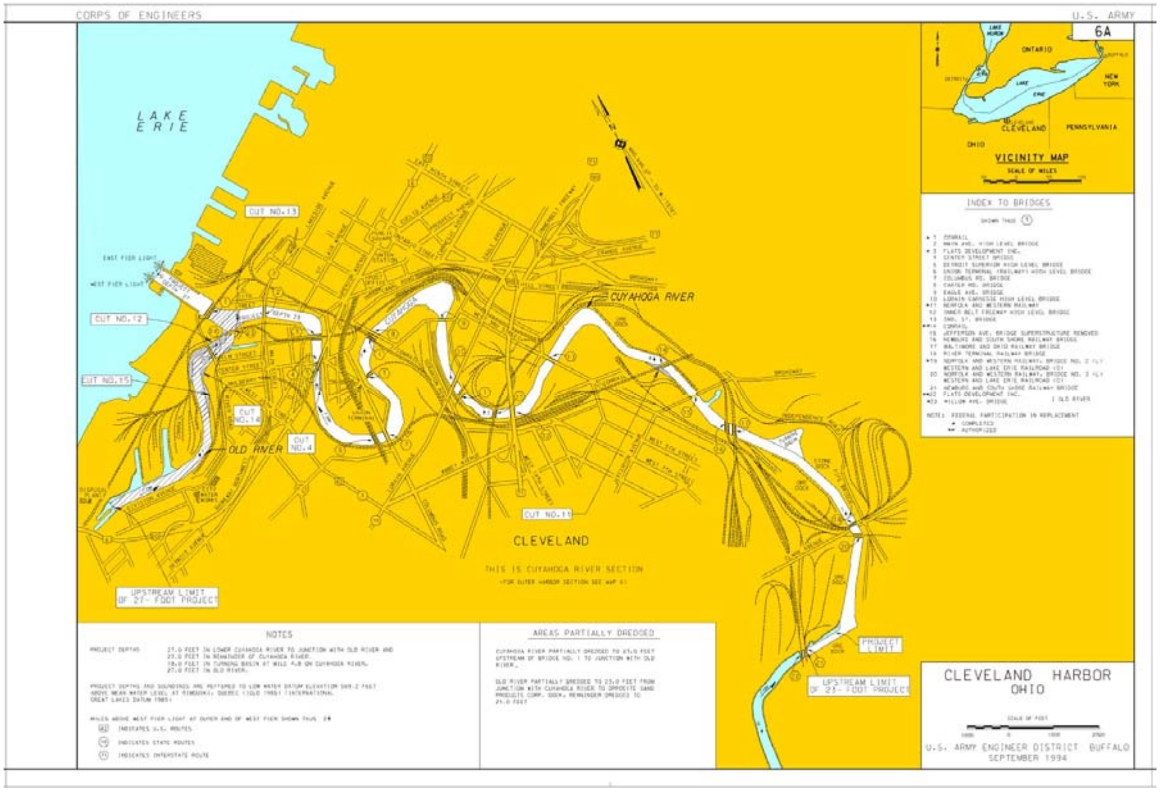


Figure 4: East 55th Street CDF

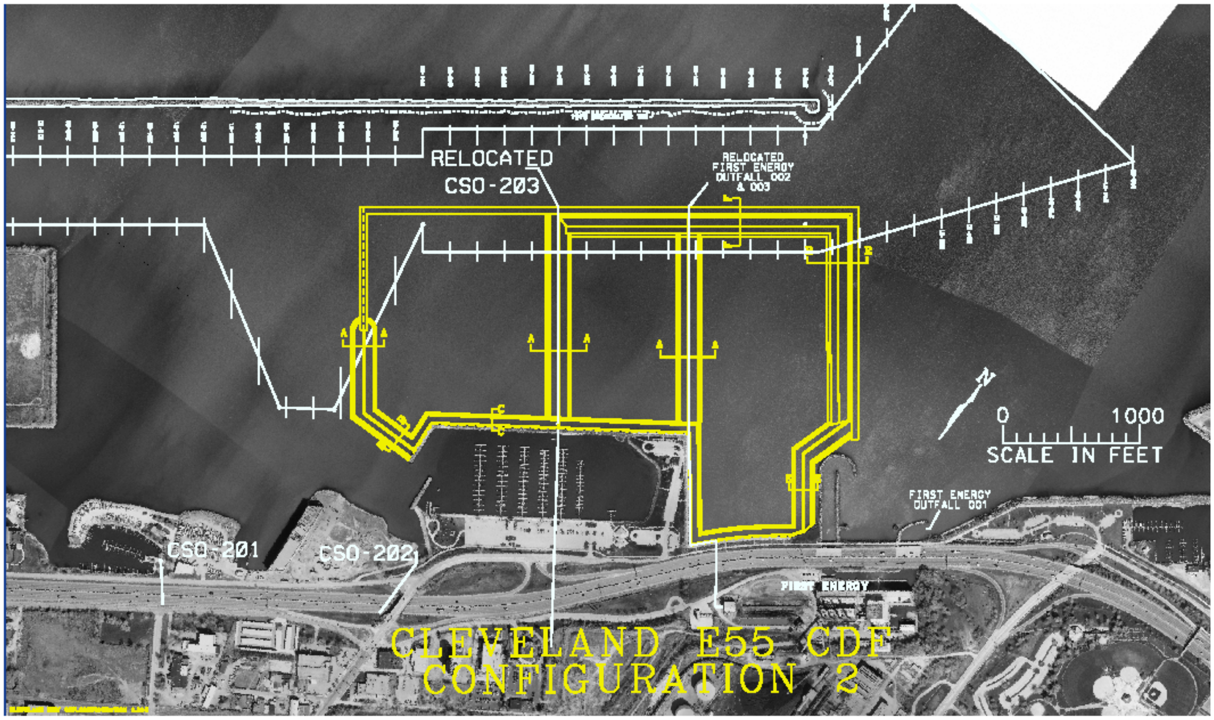
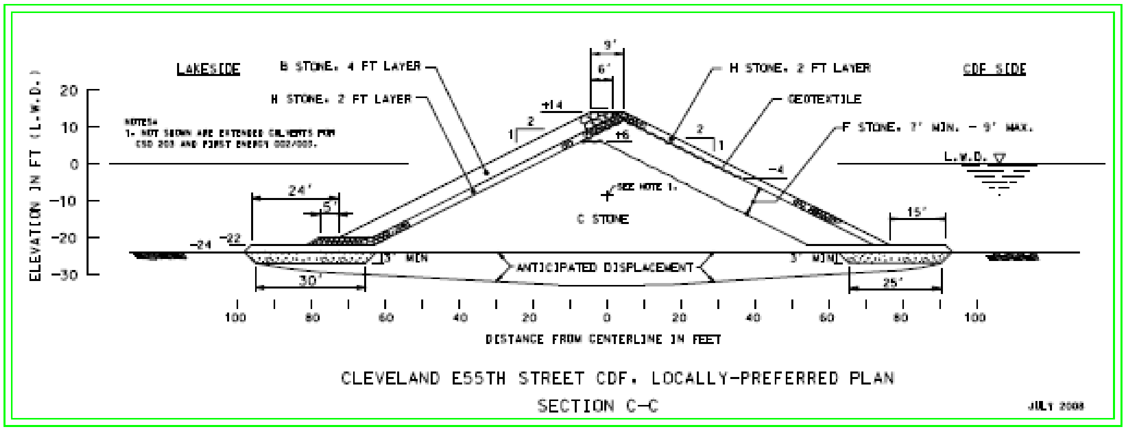


Figure 5: Typical Cross-section of rubble mound portion



NOTES:
1. NOT SHOWN ARE EXTENDED CULVERTS FOR CSO 203 AND FIRST ENERGY 002/003.

CLEVELAND E55TH STREET CDF, LOCALLY-PREFERRED PLAN
SECTION C-C

Figure 6: Typical Cross-section of steel sheet pile section

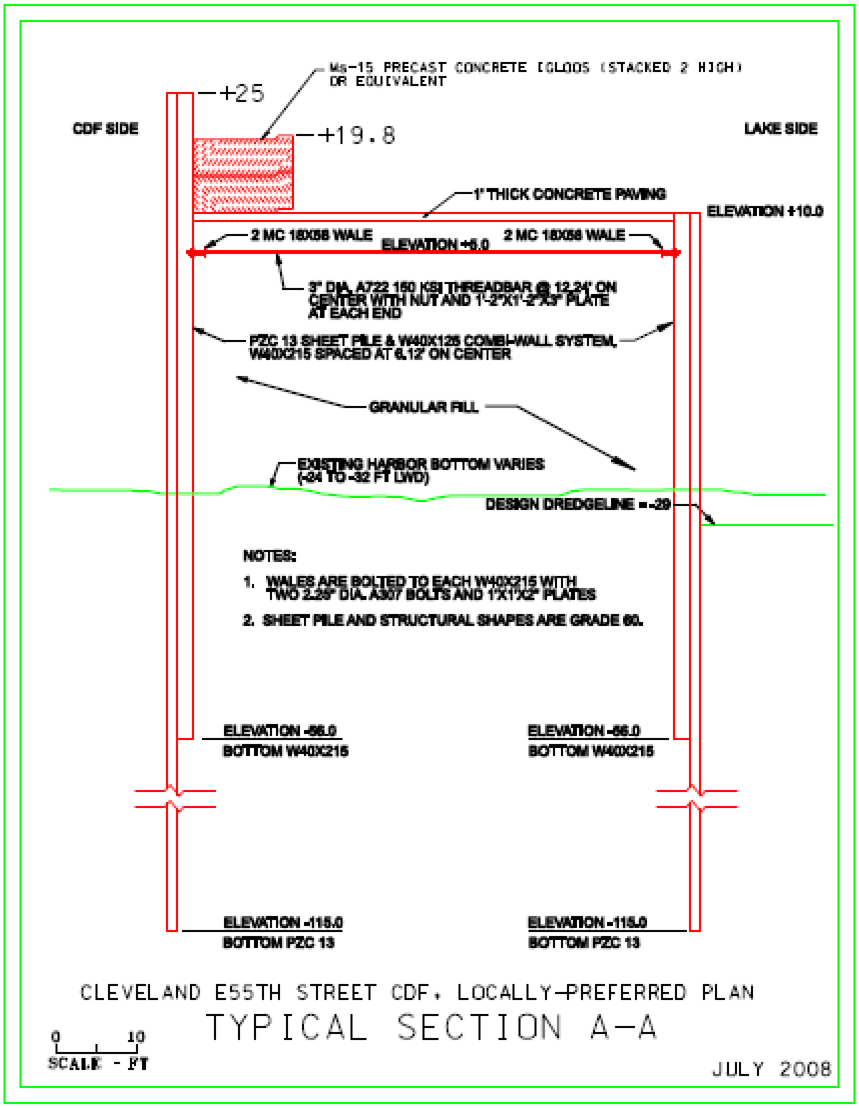


Figure 7. AVI snapshot of temperature differences during an easterly wind event with East 55th Street CDF in place

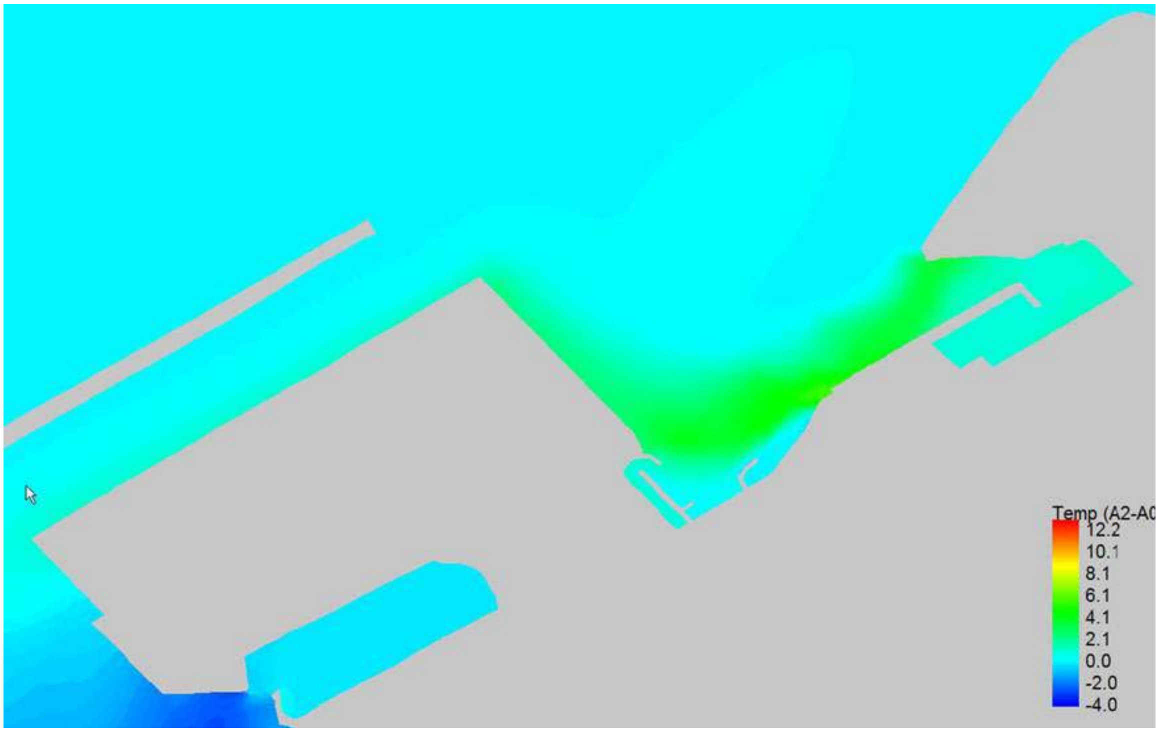


Figure 8. Advanced Visual Image (AVI) snapshot of temperature differences during a westerly wind event with East 55th Street CDF in place

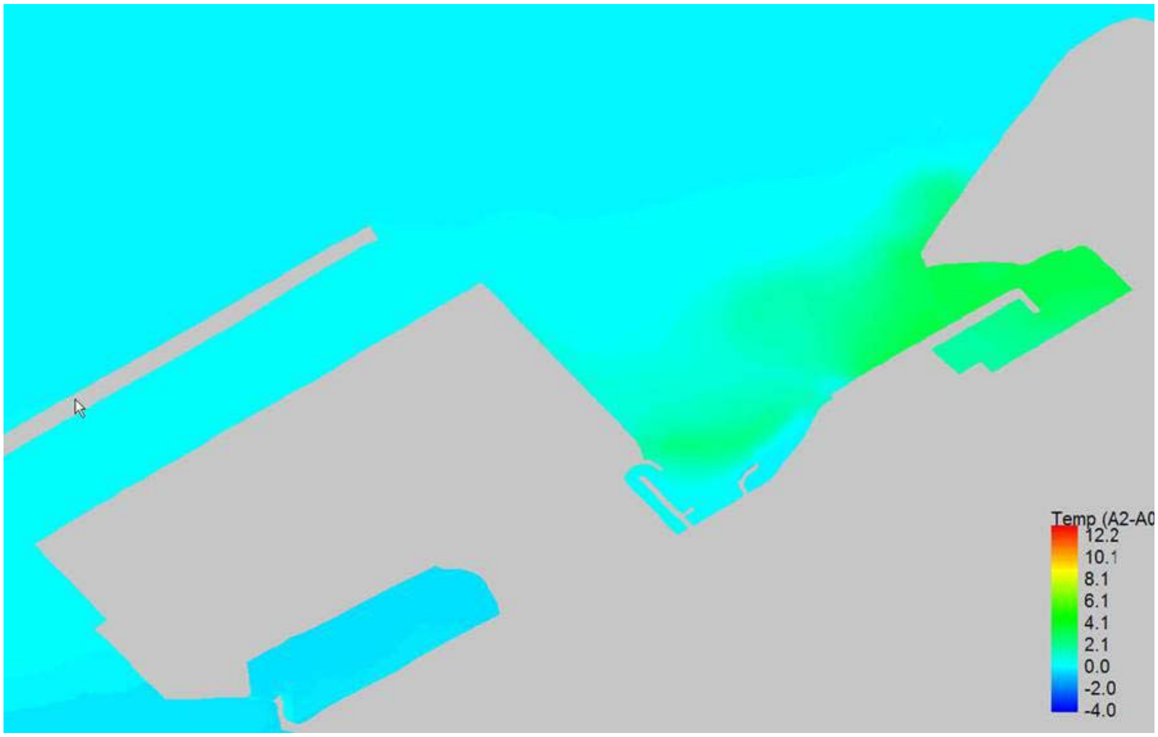


Figure 9. Existing Conditions: Peak model-generated current during November 2004 storm.

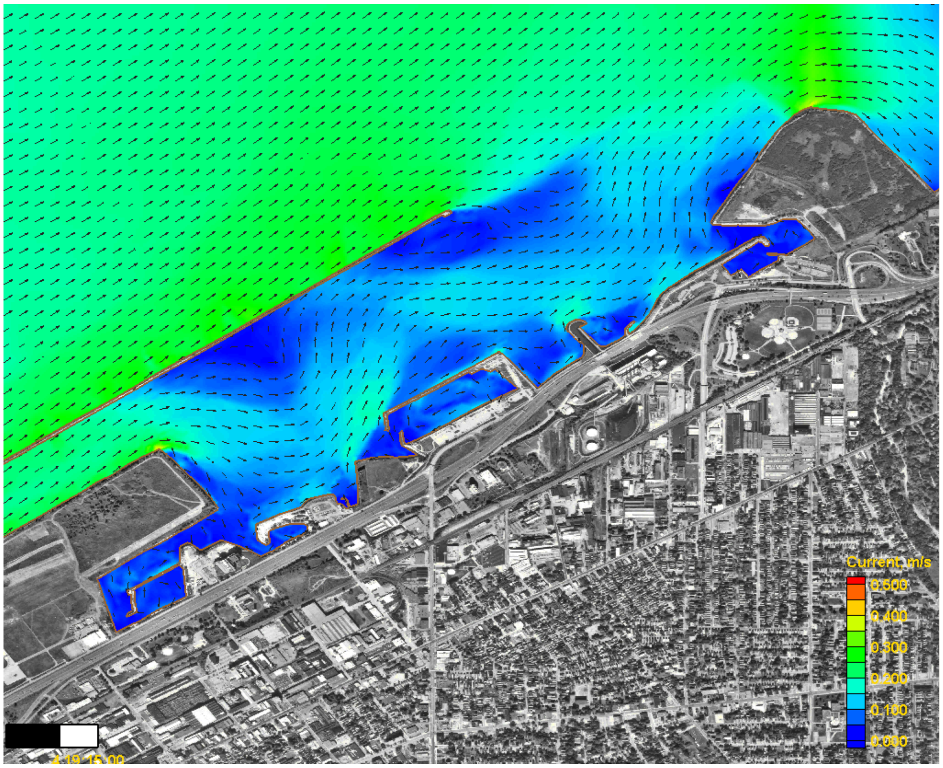
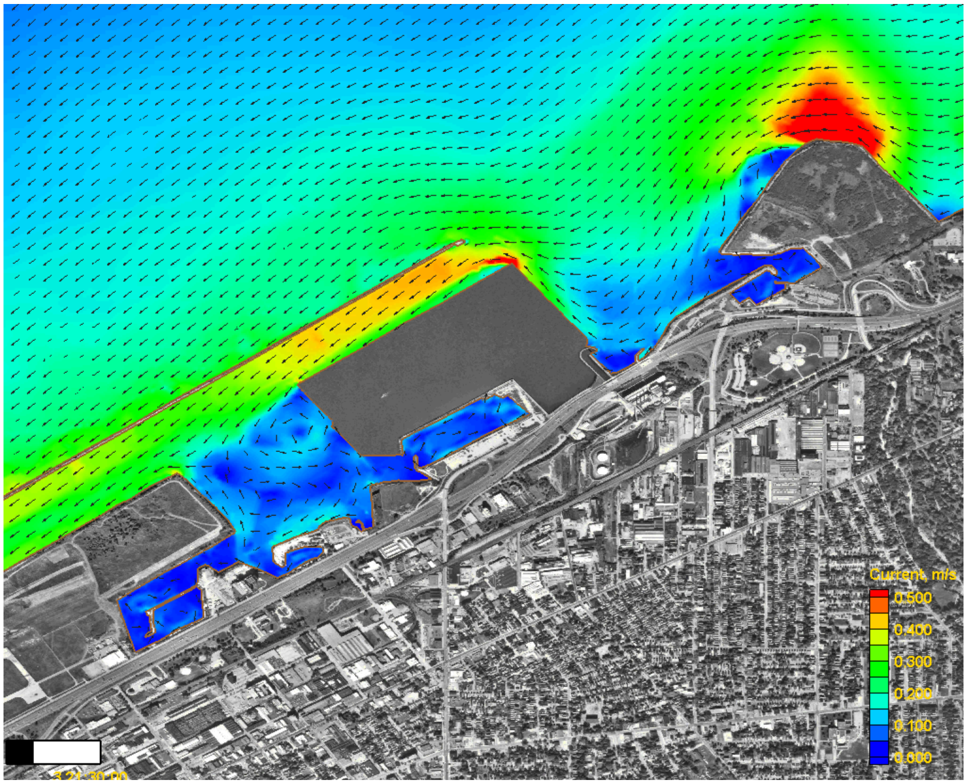


Figure 10. East 55th Street CDF: Peak model-generated current during November 2004 storm.



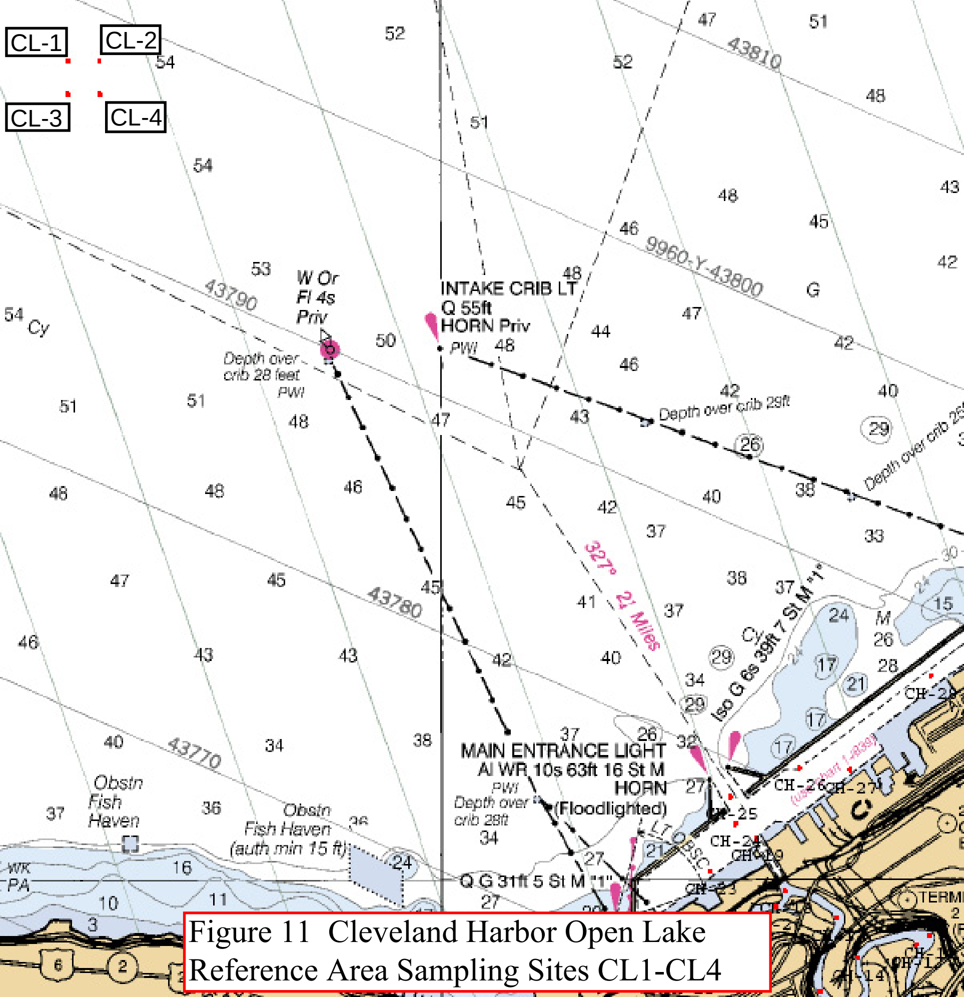


Figure 11 Cleveland Harbor Open Lake Reference Area Sampling Sites CL1-CL4

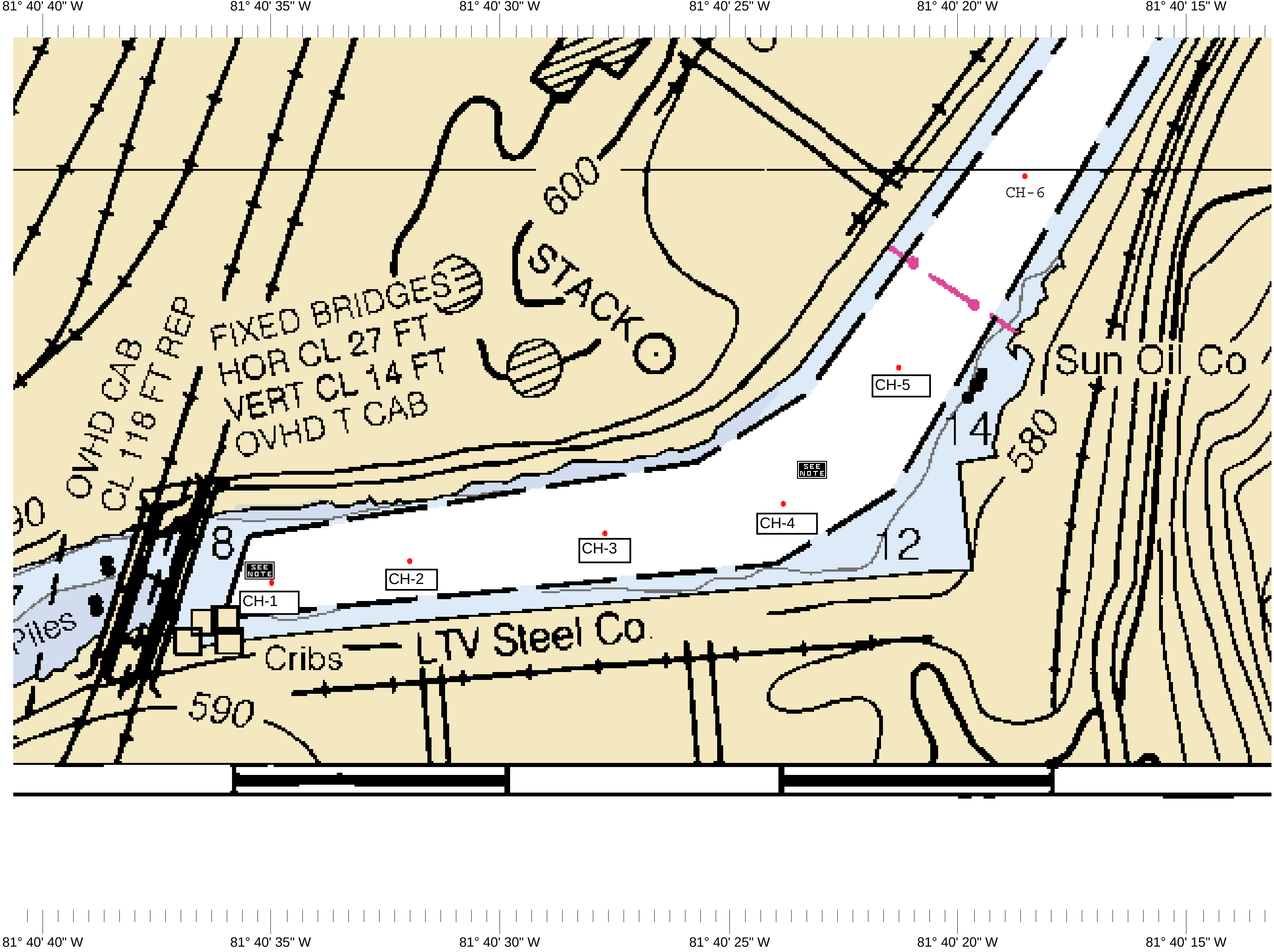


Figure 12 Cleveland Harbor Cuyahoga River Sampling Sites CH1-CH6

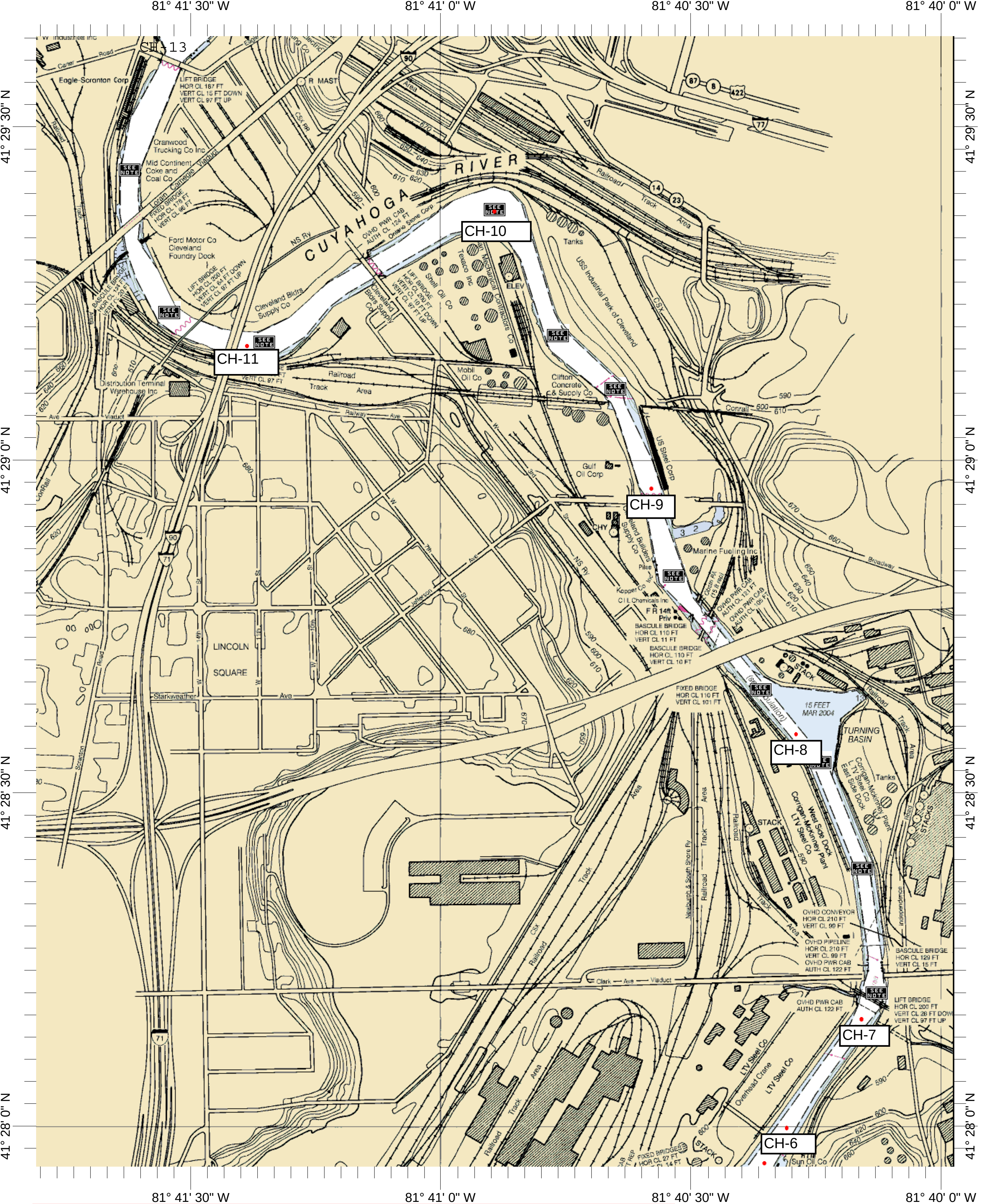


Figure 13 Cleveland Harbor Cuyahoga River Sampling Sites CH6-CH11

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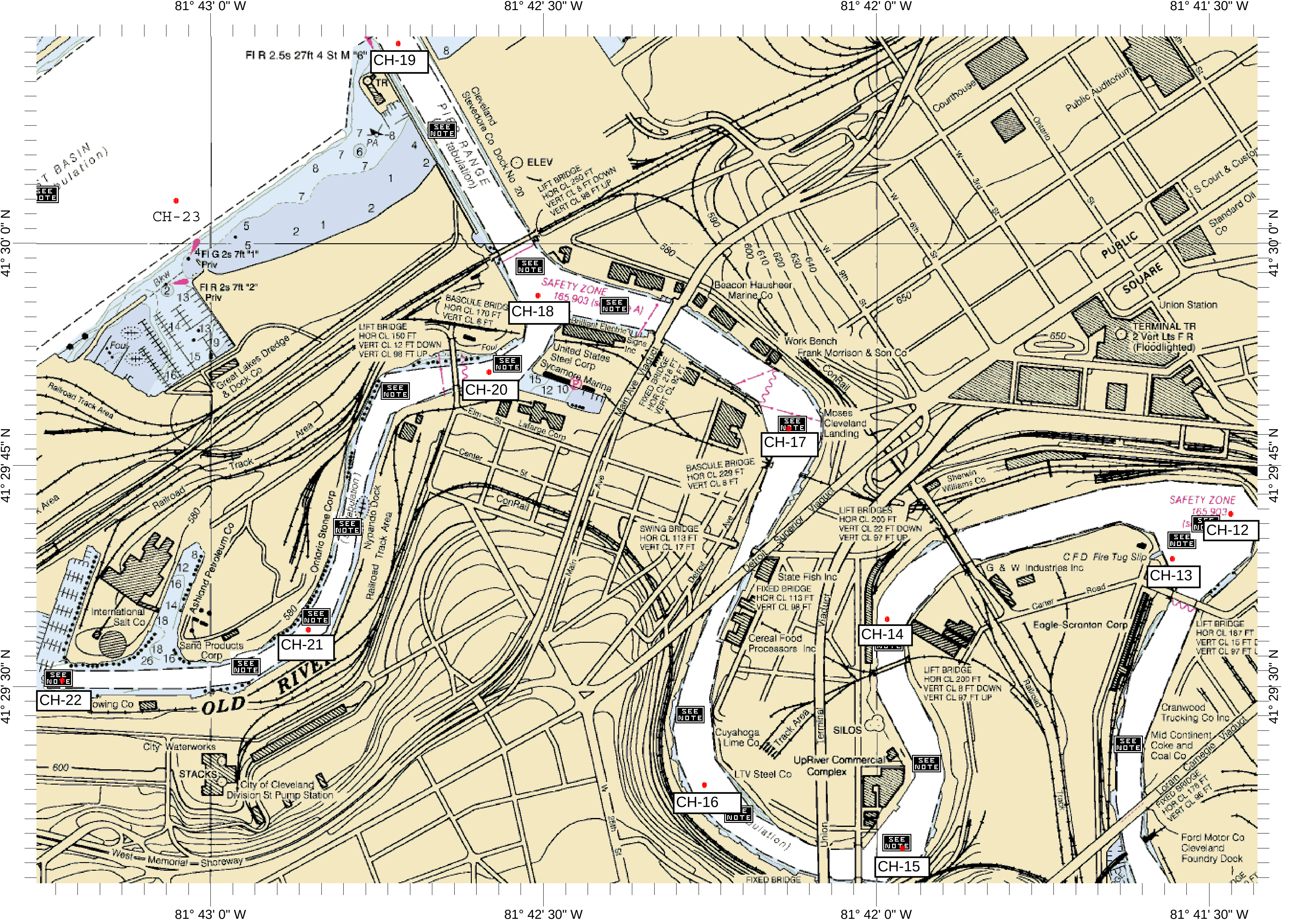

Figure 14 Cleveland Harbor Cuyahoga River Sampling Sites CH12-CH23

® MAPTECH, INC.

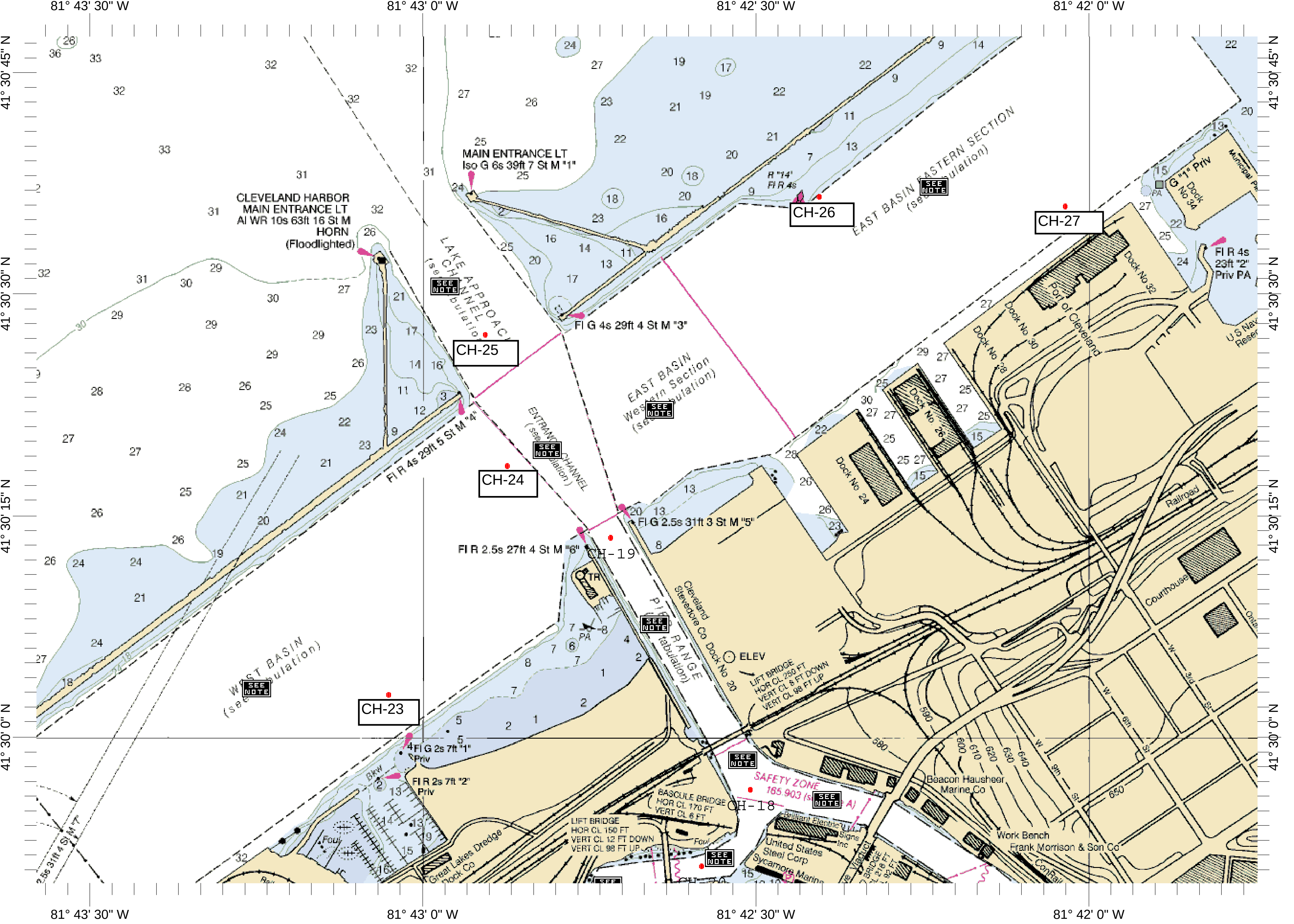

Figure 15 Cleveland Harbor Sampling Sites CH23-CH27

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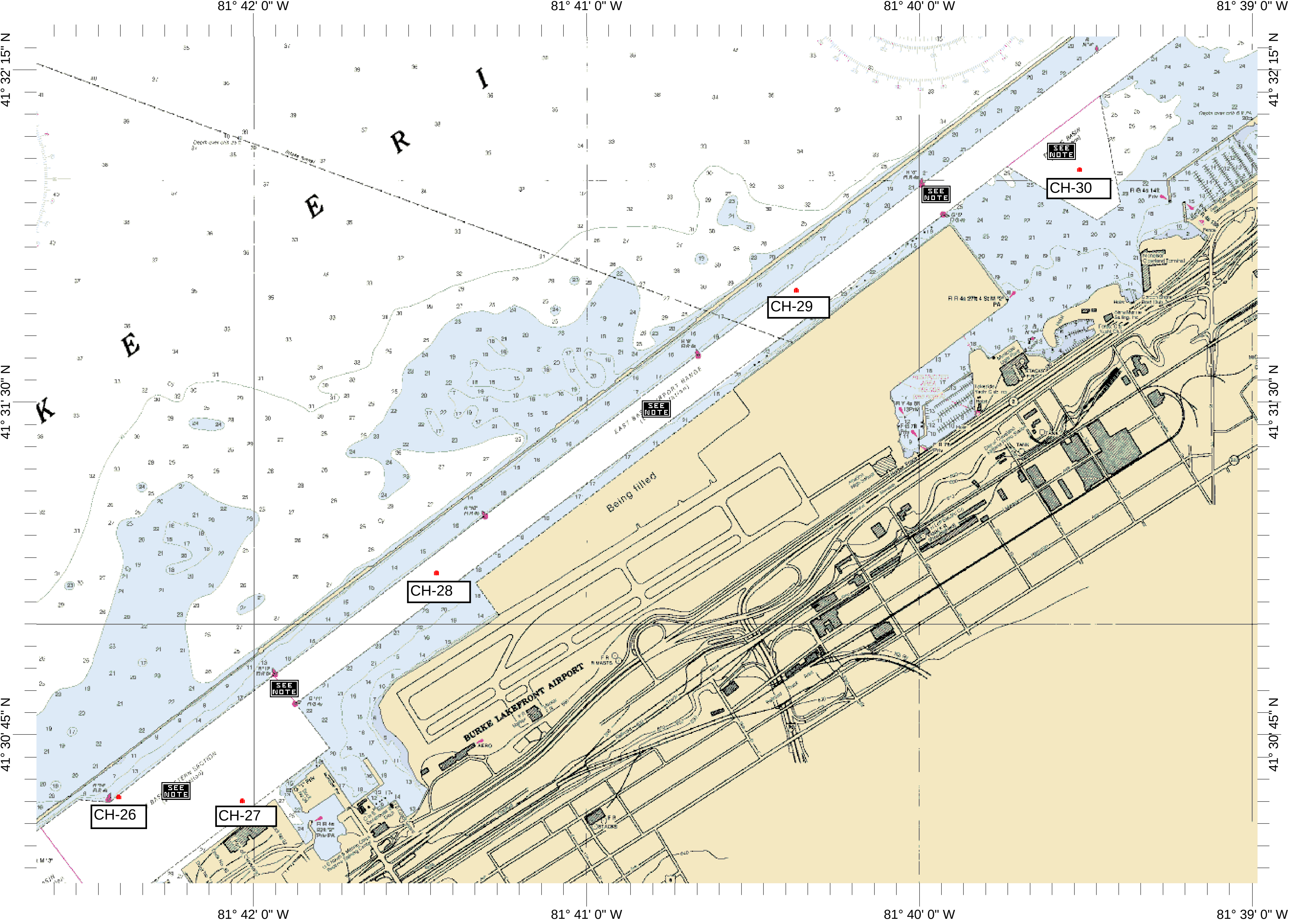

Figure 16 Cleveland Harbor Sampling Sites CH26-CH 30

Table 1. Particle size distribution of Cleveland Harbor Federal navigation channel sediments (from EEI 2007).

Particle Size Distribution	Harbor Sediments																
	Sampling Sites																
	CH-1	CH-2	CH-3	CH-4	CH-5	CH-6	CH-7	CH-8	CH-9	CH-10	CH-11	CH-12	CH-13	CH-14	CH-15	CH-16	CH-17
Clay	8.1	11.2	12.6	10.6	8.4	15.1	15.3	11.2	25.4	25.2	31.1	25.8	33.1	23.4	28.7	26.9	32.9
Silt	27.6	34.1	35.4	39.6	36.6	56.2	55.2	68.4	71.3	68.3	62	71.2	65.2	72.1	66.8	67.8	53.5
Sand	64.3	54.7	52	49.8	55	28.7	29.5	20.4	3.3	6.5	6.9	3	1.7	4.5	4.5	5.3	13.6
Gravel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Particle Size Distribution	Harbor Sediments													Open-Lake Reference Area Sediments			
	Sampling Sites													Sampling Sites			
	CH-18	CH-19	CH-20	CH-21	CH-22	CH-23	CH-24	CH-25	CH-26	CH-27	CH-28	CH-29	CH-30	CL-1	CL-2	CL-3	CL-4
Clay	24.1	18.6	12.6	14.3	28.2	38	26.3	25	36.9	48.9	46.3	45	30.3	33.8	28	38	33.7
Silt	69.4	73.6	29.2	22.3	32	53.5	70.6	72.2	58.3	50.2	51.1	53.5	60.6	64.7	70.9	60.7	64.6
Sand	6.5	2.8	56.5	63.4	39.8	8.5	3.1	2.8	4.8	0.9	2.6	1.5	9.1	1.5	1.1	1.3	1.7
Gravel	0	0	1.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2. Bulk inorganic analyses on Cleveland Harbor Federal navigation channel sediments CH1 through CH17 (from EEI 2007).

	Harbor Sediments																
	Sampling Sites																
Metal (mg/kg)	**CH-1**	**CH-2**	**CH-3**	**CH-4**	**CH-5**	**CH-6**	**CH-7**	**CH-8**	**CH-9**	**CH-10**	**CH-11**	**CH-12**	**CH-13**	**CH-14**	**CH-15**	**CH-16**	**CH-17**
Aluminum	6850	5860	6910	7720	7180	9040	8690	7950	11400	9130	10900	12800	13800	10300	9030	9560	10700
Antimony	0.895J*	0.782J	0.786J	0.849J	1.47U**	0.523J	1.55U	0.508J	**11**	1.31J	0.179U	0.157U	0.169U	0.146U	0.86	0.157U	0.180U
Arsenic	10.4	9.33	**11.1**	**14.1**	**12.5**	**14.5**	**16.8**	**12.8**	**17.4**	**13.7**	**16.1**	**20.3**	**20.2**	**19.4**	**14.5**	**14.3**	**14.4**
Barium	52.7	41.6	60	56.8	55.1	66.6	67.2	58.1	87.7	69.2	72.9	84	91.5	74.6	62.2	65.5	82.7
Beryllium	0.438J	0.387J	0.456J	0.553J	0.476J	0.561J	0.555U	0.515J	0.719J	0.571J	0.67	0.76	0.82	0.62	0.55	0.59	0.65
Cadmium	0.664J	0.456J	0.8	0.687J	0.577J	0.593J	0.311U	0.633J	1.31J	0.619J	0.99	0.96	1.6	1	0.37	0.47	1.2
Calcium	10400	10400	**13200**	**13700**	**14000**	**15100**	**14700**	**12500**	**18200**	**14200**	**15500**	**16300**	**19800**	**14200**	**13700**	**14500**	**16400**
Chromium	19.9	14.8	20.7	22.2	19.4	23.4	21.3	22.6	36	24.2	31	30.7	37.4	23.2	22.3	23	35.1
Cobalt	7.77	6.46	8.11	9.35	8.36	10.1	10.1	9.19	12.5	10.2	11.1	11.8	**14.2**	10.4	10	10.1	10.8
Copper	43.2	**55.5**	**56**	48.2	46.2	50.6	43.3	52.8	**67.8**	49.2	48.5	50.1	**67.6**	42.3	40.8	43.2	52
Iron	21000	18900	22800	27700	26000	30200	30300	27600	34100	29800	33100	35500	**42000**	33600	30600	32000	32100
Lead	36	26.1	41.6	39.8	36.7	41.8	38.9	38.2	**66.3**	41.3	45.4	43.9	62.3	37.9	36.4	41.7	45.9
Magnesium	4100	3370	4620	5090	4870	5700	5710	5070	6990	5640	7430	7780	8000	6590	5720	6170	6450
Manganese	455	397	485	498	517	661	576	462	580	525	528	585	580	512	443	434	486
Mercury	0.0855	0.0733	0.0708	0.0759	0.0702	**2.88**	0.0624	0.081	0.105	0.128	0.0793	0.0884	0.126	0.104	0.0766	0.0835	0.123
Nickel	25	34.7	28	31.7	31.2	31.4	29.7	27.7	39.1	30.9	34.1	34.4	41.4	29.4	28.5	28.7	31.2
Potassium	912	703	859	1000	926	1160	1070	988	1370	1230	1360	1560	1720	1180	1120	1180	1340
Selenium	0.752J	2.25U	1.46J	2.40U	1.5J	1.52J	2.34	1.72J	**13.9U**	1.62J	0.894U	0.785U	0.843U	0.729U	2	1.4	1.3
Silver	0.182J	0.155J	0.764U	0.802U	0.4J	0.198J	0.776U	0.194J	0.927U	0.192J	0.200J	0.26	0.33	0.250J	0.250J	0.2	0.33
Sodium	**232**	**207**	**224**	**222**	**198**	**254**	**216**	**214**	**304**	**247**	**269**	**236**	**328**	**232**	**255**	**252**	**269**
Thallium	2.91U	1.26J	1.36J	3.21U	1.03J	3.26U	1.14	1.07J	**18.5U**	3.31U	0.300J	0.42	0.49	0.37	1.9	1.8	0.360J
Vanadium	14.3	12.6	14.6	17.8	15.9	18.4	18.5	16.5	23.1	19.5	21	22.9	26.6	19.9	18.1	18.8	20.3
Zinc	156	130	137	193	170	189	167	**296**	**428**	**226**	**323**	243	**417**	194	216	**236**	**379**

	Harbor Sediments																
	Sampling Sites																
Misc. (mg/kg)	**CH-1**	**CH-2**	**CH-3**	**CH-4**	**CH-5**	**CH-6**	**CH-7**	**CH-8**	**CH-9**	**CH-10**	**CH-11**	**CH-12**	**CH-13**	**CH-14**	**CH-15**	**CH-16**	**CH-17**
Ammonia	48	98.7	**201**	69.4	66.9	101	90.6	68.7	116	**195**	89.9	101	105	99.7	91.1	98.3	153
Total cyanide	0.117J	0.104J	0.355J	0.197J	0.101J	0.469	0.116J	0.492	0.531	0.430U	0.195J	0.190J	0.499	0.3J	0.548	**1.03**	**1.08**
TOC	14200	20500	21200	21900	20100	25200	24100	17300	26500	27400	22900	20300	28000	14000	14500	14500	22300

*Estimated value between the detection limit and reporting limit.

**Not detected at or above the specified reporting limit.

Boldface/shaded values indicate a concentration that is greater in comparison to the open-lake reference area.

Table 3. Bulk inorganic analyses on Cleveland Harbor Federal navigation channel sediments CH18 through CH30 and CL1 through CL4 (from EEI 2007).

	Harbor Sediments													Open-Lake Reference Area			
	Sampling Sites													Sampling Sites			
Metal (mg/kg)	**CH-18**	**CH-19**	**CH-20**	**CH-21**	**CH-22**	**CH-23**	**CH-24**	**CH-25**	**CH-26**	**CH-27**	**CH-28**	**CH-29**	**CH-30**	**CL-1**	**CL-2**	**CL-3**	**CL-4**
Aluminum	9680	10600	5420	6460	10400	10800	9080	11700	9630	9490	11900	17200	11700	16600	19700	18600	17500
Antimony	**6.7**	0.190J	0.84	0.56	0.7	0.193U	1.2	**4.8**	1	0.197U	0.198U	0.239U	1.5	3.77U	3.87U	3.76U	3.74U
Arsenic	**16.3**	**16.5**	7.3	8.5	**15**	**12.8**	**15.9**	**20.2**	**12.8**	10	**13.8**	**17.5**	**12.9**	11	9.75	9.35	8.54
Barium	79.5	79.2	36.2	51.9	78.2	64.5	70.1	85.6	60.5	56.7	78	108	78.9	108	123	115	110
Beryllium	0.63	0.77	0.37	0.42	0.65	0.67	0.58	0.72	0.59	0.56	0.74	1.1	0.89	1.02J	1.22J	1.1J	1.07J
Cadmium	**3.4**	0.99	0.41	0.92	1.2	1	0.71	0.94	0.8	0.64	1.2	1.4	1.4	1.77J	1.97	1.78J	1.77J
Calcium	**14100**	**19500**	**22800**	**17400**	379	10300	11300	**13700**	9820	7130	11000	12000	9560	11900	12100	11300	10700
Chromium	41.5	26.1	14.8	21.2	38.3	27.2	23.8	26.9	24.4	22.1	31.3	44.5	36.2	46.6	55.7	49.6	49.9
Cobalt	11.5	10.8	6.1	5.6	9.7	11.1	10.2	12.2	10.3	9.3	12.2	**15.3**	11.4	12.8	14.1	13.7	12.8
Copper	**58.8**	47	24	32.5	**69.6**	38	48	47.1	40	32	49.8	**56.6**	53	46.6	53.4	49.2	47.1
Iron	30000	34400	18100	17700	34100	30100	28900	35900	29400	25000	33100	**45600**	**39800**	34100	39500	36800	35100
Lead	**71.5**	41.4	27.9	37.1	**127**	38.5	41	40.1	37.9	30.2	50.3	62.2	61.4	53.3	65.9	57.5	59.3
Magnesium	6160	9120	9350	6000	**12600**	5870	5320	6750	5590	4740	6740	9010	6580	10700	11500	10700	10100
Manganese	502	551	251	238	471	538	507	758	479	420	561	832	512	833	650	584	618
Mercury	0.151	0.0663	0.0352	0.0626	0.0177	0.0128	0.0763	0.0942	0.0118	0.0109	0.0122	0.0164	0.0211	0.253	0.294	0.286	0.345
Nickel	40.9	32.9	18.1	18.2	33.3	32.2	30.7	35.3	29.4	26.3	36.4	46.2	35.6	51	57.6	54.2	53.5
Potassium	1190	1250	710	808	1220	1540	1150	1450	1260	1360	154	2230	1560	2420	2790	2660	2490
Selenium	0.772U	0.744U	0.91	0.734U	1.5	2	1.7	0.792U	0.915U	1.4	1.1	1.19U	3.6	5.66U	3.94J	2.14J	5.60U
Silver	0.45	0.19	0.120J	0.170J	0.270J	0.330J	0.260J	0.280J	0.300J	0.43	0.31	0.53	0.75	1.89U	1.93U	1.88U	1.87U
Sodium	**252**	159	174	**445**	**306**	**203**	179	180	138	170	151	188	174	189	196	181	184
Thallium	0.49	6.2	0.240J	0.230J	0.47	0.6	0.46	0.42	0.38	0.58	0.57	0.51	0.82	7.55U	7.74U	7.52U	7.47U
Vanadium	21.2	21.7	12.2	11.7	19.8	22.1	19.4	23.4	19.3	18	23.5	33.5	25	36.7	43	40.6	38.5
Zinc	**339**	207	132	211	**307**	205	208	193	203	173	**259**	**299**	**238**	185	217	199	196

	Harbor Sediments													Open-Lake Reference Area			
	Sampling Sites													Sampling Sites			
Misc. (mg/kg)	**CH-18**	**CH-19**	**CH-20**	**CH-21**	**CH-22**	**CH-23**	**CH-24**	**CH-25**	**CH-26**	**CH-27**	**CH-28**	**CH-29**	**CH-30**	**CL-1**	**CL-2**	**CL-3**	**CL-4**
Ammonia	133	108	51.5	102	120	152	140	**190**	139	**165**	126	127	82	158	142	132	118
Total cyanide	**1.05**	0.111U	0.481	**2.62**	**3.63**	0.131U	0.189J	0.289J	0.121U	0.144U	0.148U	0.161U	0.153U	0.997U	1.01U	0.979U	0.965U
TOC	19900	17500	12500	6850	6780	26300	20700	20400	19400	15600	20400	15600	40000	30100	30600	29600	27000

*Estimated value between the detection limit and reporting limit.

**Not detected at or above the specified reporting limit.

Boldface/shaded values indicate a concentration that is greater in comparison to the open-lake reference area.

Table 4. Bulk Polycyclic Aromatic Hydrocarbon (PAH) analyses on Cleveland Harbor Federal navigation channel sediments CH18 through CH30 and CL1 through CL4 (from EEI 2007).

PAH compound (ug/kg)	Harbor Sediments													Open-Lake Reference Area			
	Sampling Sites													Sampling Sites			
	CH-18	**CH-19**	**CH-20**	**CH-21**	**CH-22**	**CH-23**	**CH-24**	**CH-25**	**CH-26**	**CH-27**	**CH-28**	**CH-29**	**CH-30**	**CL-1**	**CL-2**	**CL-3**	**CL-4**
Acenaphthene	54.8	11.5	38.2	12.5	23.1	14.8	22	8.07	14.5	15.5	19.4	13	46.4	10.7U*	11.9U	12U	6.48
Acenaphthylene	47	12.9	20.3	12.4	22.7	12.5	20.7	9	25.1	16.9	23.8	30.8	50.4	10.7U	6.12	12U	13.5
Anthracene	122	33.4	59.1	31.8	70.7	41.9	63.9	24.6	40.6	42.3	38.4	41.3	145	10.7U	8.61	12U	18.4
Benzo(a)Anthracene	379	131	182	127	236	136	283	102	138	165	107	131	510	16.8	45.2	39.6	57.2
Benzo(a)Pyrene	417	159	205	142	222	141	327	112	165	192	126	152	478	10.7U	15.5	10.5	75.5
Benzo(b)Fluoranthene	677	253	315	242	338	239	586	202	242	346	187	232	818	10.7U	17.9	11.5	103
Benzo(ghi)Perylene	249	86.2	107	75.7	114	74.9	206	64.3	83.5	117	68.2	80.2	224	10.7U	6.38	12U	46.3
Benzo(k)Fluoranthene	193	86.1	106	58.1	91.9	60.9	156	51.4	60.7	94.6	69.2	66.4	221	10.7U	9.83	10.5	44.2
Chrysene	466	168	221	143	244	136	375	113	127	202	114	122	593	10.7U	11.9U	12U	40.1
Dibenz(a,h)Anthracene	75.5	26.4	33	21.8	38.6	23.1	60.2	19	26.2	33.3	22.9	25.8	74.5	10.7U	11.9U	12U	11.6
Fluoranthene	815	318	387	256	404	283	662	247	237	367	214	237	1040	13.2	34.3	25.5	122
Fluorene	84.4	17.7	39.7	18.4	37.1	23.1	35.3	12.3	21	26.7	25.9	22.8	73.9	10.7U	11.9U	12U	11.1
Indeno(1,2,3-cd)Pyrene	227	83	99.1	67.5	105	69.1	194	59.3	79.4	106	65.9	78.7	212	10.7U	11.9U	12U	41.7
Naphthalene	38	4.86U	77.4	4.06U	3.25	6.26U	4.81U	5.31U	5.42U	6.45U	6.26U	7.6U	39.2	10.7U	11.9U	12U	11.5U
Phenanthrene	465	143	220	114	206	141	324	103	120	156	78	97.3	515	10.7U	11.9U	12U	14.8
Pyrene	714	260	357	248	393	227	563	193	197	292	167	185	1020	10.7U	7.19	12U	87.2
Total PAHs	**5024**	**1789**	**2467**	**1570**	**2549**	**1623**	**3878**	**1320**	**1577**	**2172**	**1327**	**1515**	**6060**	30	151	97.6	693.08

*Not detected at or above the specified reporting limit.

Boldface/shaded values indicate a concentration that is greater in comparison to the open-lake reference area.

Table 5. Bulk Polycyclic Aromatic Hydrocarbon (PAH) analyses on Cleveland Harbor Federal navigation channel sediments CH1 through CH17 (from EEI 2007).

PAH Compound (ug/kg)	**Harbor Sediments**																
	Sampling Sites																
	CH-1	**CH-2**	**CH-3**	**CH-4**	**CH-5**	**CH-6**	**CH-7**	**CH-8**	**CH-9**	**CH-10**	**CH-11**	**CH-12**	**CH-13**	**CH-14**	**CH-15**	**CH-16**	**CH-17**
Acenaphthene	16.9	10.6	9.89	31.8	32.1	46.6	24.3	18.3	6.86	14.2	9.36	25.8	14.6	29.4	14.5	21.8	17.4
Acenaphthylene	16.2	11.4	8.24	32	30.3	42	14.4	15.2	5.88	12.1	6.84	20.5	11.7	24.7	12.7	18.5	18.4
Anthracene	61.3	27.6	31.3	117	134	137	74.8	64	20.8	39.5	19.7	65.5	32.9	83.5	36.1	44.1	50.9
Benzo(a)Anthracene	213	112	142	449	424	558	270	216	102	170	84.9	224	123	355	154	168	167
Benzo(a)Pyrene	262	136	163	495	426	628	268	227	122	196	99.1	266	148	401	191	205	190
Benzo(b)Flouranthene	352	203	260	814	719	948	391	356	204	340	166	449	272	695	338	347	291
Benzo(ghi)Perylene	141	77.6	91.9	273	242	340	144	116	72.6	117	56.7	160	98.4	248	117	113	96.1
Benzo(k)Fluoranthene	131	67.1	72.3	204	165	340	135	96.5	63.5	95.8	49.2	136	79.1	202	97.3	116	97.3
Chrysene	274	149	171	594	509	657	301	246	129	225	100	312	168	497	219	231	203
Dibenz(a,h)Anthracene	38.9	21	28.7	79.2	71.8	102	39.9	33.1	21.6	31.7	16.4	43.9	26.4	69.1	32.1	36.9	30.1
Fluoranthene	534	287	334	1020	991	1310	612	487	254	419	210	548	306	863	390	400	355
Fluorene	26.9	15.2	15.3	48.8	47.4	71.6	32.7	28.7	10.2	22.2	13.2	39.9	21.3	45.2	21.8	30.2	23.1
Indeno(1,2,3-cd)Pyrene	126	70.6	84.6	257	224	314	135	106	65.9	103	51.2	144	87.4	231	109	102	91.1
Naphthalene	4.08U*	3.94U	4.47U	4.61U	6.82U	22.1U	4.79U	4.39U	5.45U	5.06U	5.03U	17.2U	5.28U	25U	5U	5.13U	5.2U
Phenanthrene	258	138	154	522	488	618	327	269	106	199	89.4	290	135	429	176	187	155
Pyrene	452	223	271	909	825	1070	508	414	202	352	159	453	240	734	317	340	296
Total PAHs	**2903**	**1549**	**1837**	**5846**	**5329**	**7182**	**3277**	**2693**	**1386**	**2337**	**1131**	**3178**	**1764**	**4907**	**2226**	**2361**	**2081**

*Not detected at or above the specified reporting limit.

Boldface/shaded values indicate a concentration that is greater in comparison to the open-lake reference area.

Table 6. Bulk Polychlorinated Biphenyl (PCB) analyses on Cleveland Harbor Federal navigation channel sediments CH1 through CH30 and CL1 through CL4 (from EEI 2007).

	Harbor Sediments																
	Sampling Sites																
Aroclor (ug/kg)	CH-1	CH-2	CH-3	CH-4	CH-5QC	CH-6	CH-7	CH-8	CH-9	CH-10	CH-11	CH-12	CH-13	CH-14	CH-15	CH-16	CH-17
1016	58.1U*	60.7U	63.8U	67.3U	63.8U	66.8U	63.9U	29.3U	36.9U	34.5U	35.9U	32.9U	38.0U	32.2U	32.5U	34.0U	36.0U
1221	58.1U	60.7U	63.8U	67.3U	63.8U	66.8U	63.9U	29.3U	36.9U	34.5U	35.9U	32.9U	38.0U	32.2U	32.5U	34.0U	36.0U
1232	58.1U	60.7U	63.8U	67.3U	63.8U	66.8U	63.9U	29.3U	36.9U	34.5U	35.9U	32.9U	38.0U	32.2U	32.5U	34.0U	36.0U
1242	58.8	56.2J**	61.6J	56.3J	**111**	51.6J	53.2J	29.3U	36.9U	34.5U	35.9U	32.9U	38.0U	32.2U	32.5U	34.0U	36.0U
1248	58.1U	60.7U	63.8U	67.3U	63.8U	66.8U	63.9U	29.3U	36.9U	34.5U	35.9U	32.9U	38.0U	32.2U	32.5U	34.0U	36.0U
1254	**163**	**75**	**63.2J**	**68**	**126**	**48.2J**	42.8J	22.2J	28.1J	30.1J	33.8J	32.9U	38.0U	32.2U	32.5U	34.0U	**46.7**
1260	29.1J	60.7U	63.8U	67.3U	32.4J	66.8U	63.9U	29.3U	36.9U	34.5U	35.9U	32.9U	38.0U	32.2U	32.5U	34.0U	27.1J
"Total"***	**251**	**192**	**189**	**192**	**269**	**167**	**160**	**80.8**	**102**	**101**	**106**	**98.7**	**114**	**96.6**	**97.5**	**102**	**110**

	Harbor Sediments													Open-Lake Reference Area Sediments			
	Sampling Sites													Sampling Sites			
Aroclor (ug/kg)	CH-18	CH-19	CH-20	CH-21	CH-22	CH-23	CH-24	CH-25	CH-26	CH-27QC	CH-28	CH-29	CH-30	CL-1	CL-2	CL-3	CL-4
1016	68.3U	65.3U	55.1U	60.9U	71.9U	77.8U	66.6U	76.4U	75.5U	90.3U	86.7U	48.8U	91.7U	78.6U	81.1U	77.1U	77.7U
1221	68.3U	65.3U	55.1U	60.9U	71.9U	77.8U	66.6U	76.4U	75.5U	90.3U	86.7U	48.8U	91.7U	78.6U	81.1U	77.1U	77.7U
1232	68.3U	65.3U	55.1U	60.9U	71.9U	77.8U	66.6U	76.4U	75.5U	90.3U	86.7U	48.8U	91.7U	78.6U	81.1U	77.1U	77.7U
1242	53.4J	43.7J	79.5	55.7J	47.7J	68.9J	60.8J	46.6J	**99.7**	**163**	**147**	48.8U	**83.0J**	78.6U	81.1U	77.1U	77.7U
1248	68.3U	65.3U	55.1U	60.9U	71.9U	77.8U	66.6U	76.4U	75.5U	90.3U	86.7U	48.8U	91.7U	78.6U	81.1U	77.1U	77.7U
1254	**56.6J**	65.3U	**73.5**	**80.9**	**75.5**	**85.3**	**64.4J**	38.7J	**138**	**260**	**221**	**62.1**	**102**	36.6J	42.8J	35.4J	37.9J
1260	68.3U	65.3U	55.1U	34.4J	30.5J	77.8U	66.6U	76.4U	44.9J	81J	62.6J	31.0J	44.4J	78.6U	81.1U	77.1U	77.7U
"Total"	**179**	**174**	**208**	**171**	**153**	**232**	**192**	**162**	**283**	**504**	**431**	**142**	**230**	36.6	42.8	35.4	37.9

*Not detected at or above the specified reporting limit.
**Estimated value between the detection limit and reporting limit.
***Sum of aroclor(s) evidenced in harbor or lake sediments, with non-detectable concentrations valued at the reporting limit.
Boldface/shaded values indicate a concentration that is greater in comparison to the open-lake reference area.

Table 7 Bulk pesticides analyses on Cleveland Harbor Federal navigation channel sediments CH18 through CH30 and CL1 through CL4 (from EEI 2007).

	Harbor Sediments													**Open-Lake Reference Area**			
	Sampling Sites													**Sampling Sites**			
Pesticide (ug/kg)	**CH-18**	**CH-19**	**CH-20**	**CH-21**	**CH-22**	**CH-23**	**CH-24**	**CH-25**	**CH-26**	**CH-27**	**CH-28**	**CH-29**	**CH-30**	**CL-1**	**CL-2**	**CL-3**	**CL-4**
4,4-DDD	2.28U	6.53U	5.51U	2.03U	7.19U	7.78JU	6.66J	7.64J	7.55J	8.85J	**13.5**	9.82J	**12.5**	7.89J	8.95J	15.5U	7.92J
4,4-DDE	2.28U	6.53U	5.51U	2.03U	7.19U	7.78U	6.66U	7.64U	7.55U	8.85U	8.67U	9.82U	9.17U	15.8U	16.2U	15.5U	15.6U
4,4-DDT	2.28U	6.53U	5.51U	2.03U	7.19U	7.78U	6.66U	7.64U	7.55U	8.85U	12.7	9.82U	9.17U	15.8U	16.2U	15.5U	15.6U
Aldrin	1.14U	3.27U	2.75U	1.02U	3.59U	3.89U	3.33U	3.82U	3.78U	4.43U	4.33U	4.91U	4.58U	7.89U	8.09U	7.76U	7.80U
Alpha-BHC	1.14U	3.27U	2.75U	1.02U	3.59U	3.89U	3.33U	3.82U	3.78U	4.43U	4.33U	4.91U	4.58U	7.89U	8.09U	7.76U	7.80U
Beta-BHC	1.14U	3.27U	2.75U	1.02U	3.59U	3.89U	3.33U	3.82U	3.78U	4.43U	4.33U	4.91U	4.58U	7.89U	8.09U	7.76U	7.80U
Chlordane	14.2U	40.8U	34.4U	12.7U	44.9U	48.6U	41.6U	47.7U	47.2U	55.3U	54.2U	61.4U	57.3U	98.7U	101U	97.0U	97.5U
Delta-BHC	1.14U	3.27U	2.75U	1.02U	3.59U	3.89U	3.33U	3.82U	3.78U	4.43U	4.33U	4.91U	4.58U	7.89U	8.09U	7.76U	7.80U
Dieldrin	2.28U	6.53U	5.51U	2.03U	7.19U	7.78U	6.66U	7.64U	7.55U	8.85U	8.67U	9.82U	9.17U	15.8U	16.2U	15.5U	15.6U
Endosulfan I	1.14U	3.27U	2.75U	1.02U	3.59U	3.89U	3.33U	3.82U	3.78U	4.43U	4.33U	4.91U	4.58U	7.89U	8.09U	7.76U	7.80U
Endosulfan II	2.28U	6.53U	5.51U	2.03U	7.19U	7.78U	6.66U	7.64U	7.55U	8.85U	8.67U	9.82U	9.17U	15.8U	16.2U	15.5U	15.6U
Endosulfan Sulfate	2.28U	6.53U	5.51U	2.03U	7.19U	3.89U	6.66U	7.64U	7.55U	8.85U	8.67U	9.82U	9.17U	15.8U	16.2U	15.5U	15.6U
Endrin	2.28U	6.53U	5.51U	2.03U	7.19U	7.78U	6.66U	7.64U	7.55U	8.85U	8.67U	9.82U	9.17U	15.8U	16.2U	15.5U	15.6U
Endrin Aldehyde	2.28U	6.53U	5.51U	2.03U	7.19U	7.78U	6.66U	7.64U	7.55U	8.85U	8.67U	9.82U	9.17U	15.8U	16.2U	15.5U	15.6U
Endrin Ketone	2.28U	6.53U	5.51U	2.03U	7.19U	7.78U	6.66U	7.64U	7.55U	8.85U	8.67U	9.82U	9.17U	15.8U	16.2U	7.76U	15.6U
Gamma-BHC	1.14U	3.27U	2.75U	1.02U	3.59U	3.89U	3.33U	3.82U	3.78U	4.43U	4.33U	4.91U	4.58U	7.89U	8.09U	7.76U	7.80U
Gamma-Chlordane	1.14U	3.27U	2.75U	1.02U	3.59U	3.89U	3.33U	3.82U	3.78U	4.43U	4.33U	4.91U	4.58U	15.8U	16.2U	15.5U	15.6U
Heptachlor	1.14U	3.27U	2.75U	1.02U	3.59U	3.89U	3.33U	3.82U	3.78U	4.43U	4.33U	4.91U	4.58U	7.89U	8.09U	15.5U	7.80U
Heptachlor Epoxide	1.14U	3.27U	2.75U	1.02U	3.59U	3.89U	3.33U	3.82U	3.78U	4.43U	4.33U	4.91U	4.58U	7.89U	8.09U	7.76U	7.80U
Methoxychlor	11.4U	32.7U	27.5U	10.2U	35.9U	38.9U	33.3U	38.2U	37.8U	44.3U	43.3U	49.1U	45.8U	78.9U	80.9U	77.6U	78.0U
Toxaphene	56.9U	163U	138U	50.8U	180U	195U	166U	191U	189U	221U	217U	245U	229U	395U	405U	388U	390U

*Not detected at or above the specified reporting limit.

**Estimated value between the detection limit and reporting limit.

Boldface/shaded values indicate a concentration that is greater in comparison to the open-lake reference area.

Table 8. Bulk pesticide analyses on Cleveland Harbor Federal navigation channel sediments CH1 through CH17 (from EEI 2007).

	Harbor Sediments																
	Sampling Sites																
Pesticide (ug/kg)	CH-1	CH-2	CH-3	CH-4	CH-5	CH-6	CH-7	CH-8	CH-9	CH-10	CH-11	CH-12	CH-13	CH-14	CH-15	CH-16	CH-17
4,4-DDD	4.70J*	6.07U**	6.38U	22.4U	20.0U	4.95J	2.13U	19.8U	8.16J	14.9J	2.38J	2.21J	2.58U	3.05	2.20U	2.06J	2.42U
4,4-DDE	5.81U	6.07U	6.38U	22.4U	20.0U	6.68U	2.13U	19.8U	24.9U	11.1J	7.19U	5.54	2.58U	2.18U	2.20U	2.28U	4.36
4,4-DDT	5.81U	6.07U	6.38U	**60.6**	**55.7**	10.2	11.3	19.8U	10.7J	11.7J	7.19U	9.52	11.6	9.9	10.3	13.1	2.42U
Aldrin	2.91U	3.03U	3.19U	11.2U	10.0U	3.34U	1.07U	9.90U	12.5U	11.6U	3.59U	1.11U	1.29U	1.09U	1.10U	1.14U	1.21U
Alpha-BHC	2.91U	3.03U	3.19U	11.2U	10.0U	3.34U	1.07U	9.90U	12.5U	11.6U	3.59U	1.11U	1.29U	1.09U	1.10U	1.14U	1.21U
Beta-BHC	2.91U	3.03U	3.19U	11.2U	10.0U	3.34U	1.07U	9.90U	12.5U	11.6U	3.59U	1.11U	1.29U	1.09U	1.10U	1.31	2.07
Chlordane	36.3U	37.9U	39.9U	140U	125U	41.8U	13.3U	124U	156U	145U	44.9U	16.8U	16.1U	13.7U	13.7U	14.3U	15.1U
Delta-BHC	2.91U	3.03U	3.19U	11.2U	10.0U	3.34U	1.07U	9.90U	12.5U	11.6U	3.59U	1.11U	1.29U	1.09U	1.10U	1.14U	1.21U
Dieldrin	5.81U	6.07U	6.38U	22.4U	20.0U	6.68U	2.13U	19.8U	24.9U	**11.6**	7.19U	2.21U	2.58U	1.09U	2.20U	2.28U	2.42U
Endosulfan I	2.91U	6.07U	3.19U	11.2U	10.0U	3.34U	1.07U	9.90U	12.5U	11.6U	3.59U	1.11U	1.29U	1.09U	1.10U	2.28U	1.21U
Endosulfan II	2.91U	3.03U	6.38U	22.4U	20.0U	6.68U	2.13U	19.8U	24.9U	11.2J	7.19U	2.21U	2.58U	2.18U	2.20U	1.14U	2.42U
Endosulfan Sulfate	5.81U	6.07U	6.38U	22.4U	20.0U	6.68U	2.13U	19.8U	24.95U	11.6U	7.19U	2.21U	2.58U	2.18	2.20U	2.28U	2.42U
Endrin	5.81U	6.07U	6.38U	22.4U	20.0U	6.68U	2.13U	19.8U	24.9U	23.2U	7.19U	2.21U	2.58	1.09U	2.20U	2.28U	2.42U
Endrin Aldehyde	2.91U	6.07U	6.38U	22.4U	20.0U	6.68U	2.13U	19.8U	24.9U	7.23J	7.19U	2.21U	2.58U	2.18U	2.20U	2.28U	2.42U
Endrin Ketone	5.81U	6.07U	6.38U	22.4U	20.0U	6.68U	2.13U	19.8U	24.9U	8.34J	7.19U	2.21U	2.58U	2.18U	2.20U	1.14U	2.42U
Gamma-BHC	2.91U	3.03U	3.19U	11.2U	10.0U	3.34U	1.07U	9.90U	12.5U	11.6U	3.59U	1.11U	1.29U	1.09U	1.10U	1.14U	1.21U
Gamma-Chlordane	2.91U	3.03U	3.19U	11.2U	10.0U	3.34U	1.07U	9.90U	12.5U	11.6U	3.59U	1.11U	1.29U	1.09U	1.10U	1.14U	1.21U
Heptachlor	2.91U	3.03U	3.19U	11.2U	10.0U	3.34U	1.07U	9.90U	12.5U	11.6U	3.59U	1.11U	1.29U	1.09U	1.10U	1.14U	1.21U
Heptachlor Epoxide	2.91U	3.03U	3.19U	11.2U	10.0U	3.34U	1.07U	9.90U	12.5U	11.6U	3.59U	1.11U	1.29U	1.09U	1.10U	1.14U	1.21U
Methoxychlor	29.1U	30.3U	31.9U	112U	100U	33.4U	10.77U	99.0U	125U	36J	35.9U	11.1U	12.9U	10.9U	11.0U	1.14U	12.1U
Toxaphene	145U	152U	159U	561U	501U	167U	53.3U	495U	623U	579U	180U	55.3U	64.5U	54.6U	55.0U	57.0U	60.4U

*Estimated value between the detection limit and reporting limit.

**Not detected at or above the specified reporting limit.

Boldface/shaded values indicate a concentration that is greater in comparison to the open-lake reference area.

Table 9. Inorganic Modified Elutriate Test results on Cleveland Harbor Federal navigation sediments (from EEI 2007).

	Harbor Sediments									
	Sampling Sites									
	CH-UEMU		**CH-URMU**		**CH-LRMU**		**CH-OHMU**		**CH-ORMU**	
Metal (µg/L)	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**
Aluminum	4970	51.4	4970	126	2940	35.1	4530	46.9	3810	69
Antimony	1.3	0.89	2.3	0.85	1.7	1.1	0.5U	0.5U	0.8	0.75
Arsenic	16	4.6	13	9.4	16	12.1	10	4	7	4.1
Barium	81.9	32.3	83.2	46.4	82.2	59.1	104	67.7	53.4	30.2
Beryllium	0.42	0.1U*	0.31	0.1U	0.19	0.1U	0.2	0.1U	0.22	0.1U
Cadmium	0.88	0.11U	1.7	0.11U	1.1	0.11U	0.34	0.11U	0.39	0.11U
Calcium	49900	45900	55700	55400	59800	57800	44600	44200	36600	36100
Chromium	15.9	1U	17.8	1U	11	1U	7.3	1U	9.1	1U
Cobalt	5.1	1.2	4	1.6	2.5	1.1	2.8	1.1	2.1	1.2
Copper	37.5	1.3	27.9	1.5	18.1	0.66	11	1.1	13	1.5
Iron	13200	267	9090	582	5930	651	6280	245	5560	199
Lead	33.2	0.5U	30.3	0.77	20.9	0.5U	11.9	0.5U	13.8	0.5U
Magnesium	13300	11400	13500	13600	13800	13300	10800	10400	9820	8600
Manganese	748	323	430	396	591	509	1660	1530	248	157
Mercury	0.0398	0.0012	0.0391	0.0024	0.0267	0.0017	0.0212	0.00099	0.0251	0.0011
Nickel	20.6	4.1	17.3	5.4	11.7	4	9.1	3	8.2	2.2
Potassium	8030	6460	7750	7230	7080	6810	5010	4290	4520	3620
Selenium	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
Sodium	22100	21200	25500	29900	28600	25000	20700	18500	22500	23400
Thallium	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.51	0.3U
Vanadium	14.1	3U	7.4	3U	4.8	3U	5.2	3U	4.5	3U
Zinc	131	3.4	163	7.4	103	2.8	48.5	3.3	61.2	6.6

	CH-UEMU		**CH-URMU**		**CH-LRMU**		**CH-OHMU**		**CH-ORMU**	
Misc. (mg/L)	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**
Ammonia	6.06	5.93	11	9.37	8.74	8.67	7.52	7.32	5.22	7.22
Total cyanide	0.00232J	0.00226J	0.0021J	0.00361J	0.0015U	0.0038	0.005U	0.00331U	0.00237J	0.0034J

*Not detected at or above the specified reporting limit.

**Estimated value between the detection limit and reporting limit.

Table 10. PAH Modified Elutriate Test results on Cleveland Harbor Federal navigation sediments (from EEI 2007).

	Harbor Sediments									
	Sampling Sites									
	CH-UEMU		**CH-URMU**		**CH-LRMU**		**CH-OHMU**		**CH-ORMU**	
PAH compound (µg/L)	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**
Acenaphthene	0.481U*	0.521U	0.485U	0.521U	0.197J**	0.521U	0.481U	0.521U	0.472U	0.521U
Acenaphthylene	0.481U	0.521U	0.485U	0.521U	0.481U	0.521U	0.481U	0.521U	0.472U	0.521U
Anthracene	0.481U	0.521U	0.485U	0.521U	0.481U	0.521U	0.481U	0.521U	0.472U	0.521U
Benzo(a)Anthracene	0.104	0.0786	0.127	0.0776	0.149	0.156	0.0839	0.0855	0.091	0.0784
Benzo(a)Pyrene	0.113	0.0917	0.152	0.0961	0.168	0.181	0.122	0.112	0.137	0.0957
Benzo(b)Fluoranthene	0.201	0.184	0.36	0.125	0.223	0.405	0.241	0.129	0.23	0.118
Benzo(ghi)Perylene	0.106	0.0871	0.142	0.0704	0.129	0.143	0.0762	0.0698	0.0693	0.0609
Benzo(k)Fluoranthene	0.024U	0.026U	0.0243U	0.026U	0.024U	0.026U	0.024U	0.026U	0.105	0.026U
Chrysene	0.134	0.113	0.17	0.0929	0.167	0.172	0.0918	0.0851	0.0922	0.0786
Dibenz(a,h)Anthracene	0.0481U	0.0521U	0.0485U	0.0521U	0.0481U	0.0521U	0.0481U	0.0521U	0.472U	0.0521U
Fluoranthene	0.287	0.234	0.379	0.169	0.411	0.254	0.213	0.149	0.134	0.0989
Fluorene	0.481U	0.521U	0.485U	0.521U	0.123J	0.521U	0.481U	0.521U	0.472U	0.521U
Indeno(1,2,3-cd)Pyrene	0.0481U	0.0521U	0.0485U	0.0521U	0.0481U	0.0521U	0.0481U	0.0521U	0.0472U	0.0521U
Naphthalene	0.481U	0.521U	0.485U	0.521U	0.481U	0.521U	0.481U	0.521U	0.472U	0.521U
Phenanthrene	0.481U	0.521U	0.294J	0.521U	0.258J	0.521U	0.481U	0.521U	0.472U	0.521U
Pyrene	0.303	0.249	0.444	0.203	0.506	0.386	0.268	0.159	0.237	0.154

*Not detected at or above the specified reporting limit.

**Estimated value between the detection limit and reporting limit.

Table 11. PCB Modified Elutriate Test results on Cleveland Harbor Federal navigation sediments (from EEI 2007).

	Harbor Sediments									
	Sampling Sites									
	CH-UEMU		CH-URMU		CH-LRMU		CH-ORMU		CH-OHMU	
Aroclor (µg/L)	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
1016	0.0952U*	0.0106U	0.100U	0.103U	0.0952U	0.104U	0.098U	0.103U	0.0962U	0.0102U
1221	0.0952U	0.0106U	0.100U	0.103U	0.0952U	0.104U	0.098U	0.103U	0.0962U	0.0102U
1232	0.0952U	0.0106U	0.100U	0.103U	0.0952U	0.104U	0.098U	0.103U	0.0962U	0.0102U
1242	0.0952U	0.0106U	0.100U	0.103U	0.0952U	0.104U	0.098U	0.103U	0.0962U	0.0102U
1248	0.0952U	0.0106U	0.100U	0.103U	0.0952U	0.104U	0.098U	0.103U	0.0962U	0.0102U
1254	0.0952U	0.0106U	0.100U	0.103U	0.0952U	0.104U	0.098U	0.103U	0.0962U	0.0102U
1260	0.0952U	0.0106U	0.100U	0.103U	0.0952U	0.104U	0.098U	0.103U	0.0962U	0.0102U

*Not detected at or above the specified reporting limit.

Table 12. Pesticide Modified Elutriate Test results on Cleveland Harbor Federal navigation sediments (from EEI 2007).

	Harbor Sediments									
	Sampling Sites									
	CH-UEMU		CH-URMU		CH-LRMU		CH-OHMU		CH-ORMU	
Pesticide (µg/L)	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**
4,4-DDD	0.189U	0.222U	0.200U	0.222U	0.192U	0.222U	0.0388U	0.0444U	0.196U	0.222U
4,4-DDE	0.189U	0.222U	0.200U	0.222U	0.192U	0.222U	0.0388U	0.0444U	0.196U	0.222U
4,4-DDT	0.189U	0.222U	0.200U	0.222U	0.192U	0.222U	0.0388U	0.0444U	0.196U	0.222U
Aldrin	0.0943U	0.111U	0.100U	0.111U	0.0962U	0.111U	0.0194U	0.0222U	0.098U	0.111U
Alpha-BHC	0.0943U	0.111U	0.100U	0.111U	0.0962U	0.111U	0.0194U	0.0222U	0.098U	0.111U
Alpha-Chlordane	0.0943U	0.111U	0.100U	0.111U	0.0962U	0.111U	0.0194U	0.0222U	0.098U	0.111U
Beta-BHC	0.0943U	0.111U	0.100U	0.111U	0.192U	0.111U	0.0194U	0.0222U	0.098U	0.111U
Chlordane	1.18U	1.39U	1.25U	1.39U	1.20U	1.39U	0.243U	0.278U	1.23U	1.39U
Delta-BHC	0.0943U	0.111U	0.100U	0.111U	0.0962U	0.111U	0.0194U	0.0222U	0.098U	0.111U
Dieldrin	0.189U	0.222U	0.200U	0.222U	0.192U	0.222U	0.0388U	0.0444U	0.196U	0.222U
Endosulfan I	0.0943U	0.111U	0.100U	0.111U	0.0962U	0.111U	0.0194U	0.0222U	0.098U	0.111U
Endosulfan II	0.189U	0.222U	0.200U	0.222U	0.192U	0.222U	0.0388U	0.0444U	0.196U	0.222U
Endosulfan Sulfate	0.189U	0.222U	0.200U	0.222U	0.192U	0.222U	0.0388U	0.0444U	0.196U	0.222U
Endrin	0.189U	0.222U	0.200U	0.222U	0.192U	0.222U	0.0388U	0.0444U	0.196U	0.222U
Endrin Aldehyde	0.189U	0.222U	0.200U	0.222U	0.192U	0.222U	0.0388U	0.0444U	0.196U	0.222U
Endrin Ketone	0.189U	0.222U	0.200U	0.222U	0.192U	0.222U	0.0388U	0.0444U	0.196U	0.222U
Gamma-BHC	0.0943U	0.111U	0.100U	0.111U	0.0962U	0.111U	0.0194U	0.0222U	0.098U	0.111U
Gamma-Chlordane	0.0943U	0.111U	0.200U	0.111U	0.0962U	0.111U	0.0194U	0.0444U	0.098U	0.111U
Heptachlor	0.0943U	0.111U	0.100U	0.111U	0.0962U	0.111U	0.0194U	0.0222U	0.098U	0.111U
Heptachlor Epoxide	0.0943U	0.111U	0.100U	0.111U	0.0962U	0.111U	0.0194U	0.0222U	0.098U	0.111U
Methoxychlor	0.943U	1.11U	0.100U	1.11U	0.962U	1.11U	0.194U	0.222U	2.45U	1.11U
Toxaphene	2.36U	2.78U	2.50U	2.78U	2.40U	2.78U	0.485U	0.556U	2.45U	2.78U

*Not detected at or above the specified reporting limit.

APPENDIX E

RISK ASSESSMENT

US Army Corps of Engineers
Buffalo District

CONTAMINANT MONITORING ASSESSMENT
CLEVELAND HARBOR
CONFINED DISPOSAL FACILITY 10B
CLEVELAND, OHIO

August 2007

CONTAMINANT MONITORING ASSESSMENT
CLEVELAND HARBOR
CONFINED DISPOSAL FACILITY 10B
CLEVELAND NY

EXECUTIVE SUMMARY

This contaminant monitoring assessment was completed in order to determine whether or not further management actions need to be taken at the dredged material confined disposal facilities (CDFs) under the jurisdiction of the Buffalo District of the US Army Corps of Engineers, in order to ensure protection of human health and the environment. This report followed guidance contained in the *Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities – Testing Manual* (UTM) (USACE 2003). The guidance contained within the UTM is technical and not regulatory in nature. It should be noted that the use of threshold levels such as criteria, guidelines, risk-based screening levels, etc. should not be mistaken for regulatory standards. This evaluation followed a tiered approach. Two tiers of evaluation were completed and are presented in this report. Based on this evaluation, it was determined that management actions are not necessary because contaminants in the Cleveland Harbor CDF 10B dredged material are not migrating into the environment outside the facility at levels that would pose a risk to human health or the environment.

The first Tier involved using a risk-based approach, in which potential contaminant migration pathways were identified. The migration pathways are routes by which contaminants or constituents of potential concern associated with dredged material contained in CDFs may move from the dredged material within the site into the environment outside the facility (USACE 2003). Secondly, environmental or human receptors outside of the CDF were identified. These receptors have the potential to be exposed to contaminants associated with the dredged material from within the CDF, once the contaminants migrate outside the facility. Thirdly, risk-based screening levels were identified that protected the identified receptors that could be exposed via the identified migration pathways. The levels of constituents measured in the dredged material were compared to the risk-based criteria in this Tier I evaluation.

This Tier I evaluation concluded that there is enough information to dismiss from further concern, some of the contaminants in the CDF. However, there is not enough information at this stage to eliminate the following potentially complete pathways and contaminants of plant bioaccumulation of cadmium, copper, and zinc; and animal bioaccumulation of DDT, DDE, and PCBs.

These pathways and constituents were carried forward to a Tier III evaluation, i.e., plant and earthworm bioassays were conducted on Cleveland Harbor CDF 10B dredged material and compared to reference area soils from the Cleveland Lakefront State Park. Plant uptake of metals by *Cyperus esculentus* grown in dredged material from the Cleveland Harbor CDF 10B did not exceed uptake from the Reference material. Since the availability of metals to plant uptake in the Cleveland Harbor CDF 10B was lower than from the Reference soil, there is no increased risk associated with the plant uptake of contaminants from the Cleveland Harbor CDF 10B. Earthworms exposed to Cleveland Harbor CDF 10B dredged material and Reference material were analyzed for PCBs and DDT pesticides. While uptake of PCB (as Arochlor 1248) in the dredged material exceeded that of the Reference material, the concentrations were determined to be well below minimum dietary concentration posing adverse risks to higher animals. Earthworms exposed to dredged material showed higher concentrations of DDT, DDE and DDD compared to the Reference. However, these concentrations were 2 orders of magnitude less than minimum dietary concentrations causing adverse effects to higher animals.

The intended post-closure beneficial use of the CDF is for airport expansion. Federal Aviation Administration regulations will likely require a vegetative cover that reduces hazards for airport operations. This will likely require that vegetative cover be a turf-type that has little attraction for wildlife, particularly birds. Based on the results of this study, this beneficial use activity will not result in increased migration of contaminants outside the CDF. Uptake of cadmium by plants will be minimized by maintaining soil pH and limiting growth of woody species. Management in post-closure use should include the establishment of turf grass and management of soil pH between 7.5 and 6.5. Fine fescues are recommended but other turf species may be used as well.

CONTAMINANT MONITORING ASSESSMENT
CLEVELAND HARBOR
CONFINED DISPOSAL FACILITY 10B
CLEVELAND, OHIO

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ABBREVIATIONS AND ACRONYMS

BEHP	Bis(2-ethylhexyl)phthalate
BNAs	Base neutral and acid extractable compounds
CAA	Clean Air Act
CCC	Criteria Continuous Concentration
CDF	Confined Disposal Facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMC	Criteria Maximum Concentration
COC	Constituent of Concern
DDT	Dichlorodiphyenyltrichloroethane
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
HTRW	Hazardous, Toxicological, Radiological Waste Sites
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFTA	Niagara Frontier Transportation Authority
NYSDEC	New York State Department of Environmental Conservation
OSHA	Occupational Safety and Health Administration
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PEC	Probable Effects Concentrations
PL	Public Law
PPL	Priority Pollutant List
PRG	Preliminary Remediation Goal
SERA	Screening Ecological Risk Analysis
TEC	Threshold Effects Concentrations
TOC	Total Organic Carbon
UTM	Upland Confined Disposal Facilities – Testing Manual
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VOCs	Volatile Organic Compounds

1.0 INTRODUCTION

1.1 Objective

The objective of this evaluation is to determine whether or not further management actions need to be taken at the dredged material confined disposal facilities (CDFs) under the jurisdiction of the Buffalo District of the US Army Corps of Engineers, in order to ensure protection of human health and the environment. Management actions would be recommended if it is determined that contaminants are migrating from dredged material within the CDF into the environment outside the facility at levels that would pose a risk to human health or the environment. This report followed guidance contained in the *Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities – Testing Manual* (UTM), and follows a risk-based approach (USACE 2003). The guidance contained within the UTM is technical and not regulatory in nature. It should be noted that the use of threshold levels such as criteria, guidelines, risk-based screening levels, etc. should not be mistaken for regulatory standards. This evaluation followed a tiered approach, and concluded after the third tier.

1.2 History

Commercial navigation is a critical element of the national economy. Shipping channels and harbors require periodic dredging to maintain required depths. The US Army Corps of Engineers (USACE) dredges, relocates, and disposes of hundreds of millions of cubic yards of sediment annually. Over one hundred harbors and channels are presently maintained in the U.S. Great Lakes by the USACE, including several areas that the International Joint Commission has described as Areas of Concern due to, among other factors, contaminated sediments. The fate of these contaminated sediments has been a public health issue because of potential human exposure or contamination of biota.

Section 123 of Public Law (PL) 91-611 (1970) authorized the USACE to construct, operate, and maintain confined disposal facilities (CDFs) in Great Lakes harbors where dredged materials have been deemed to be unsuitable for open-lake disposal. A CDF is an engineered structure consisting of dikes or other structures that extend above any adjacent water surface and enclose a disposal area for containment of dredged material, isolating the dredged material from adjacent waters or land (USACE and USEPA 1992). Of the approximately four million cubic yards of sediments dredged annually from Federal navigation projects in the Great Lakes, about half are placed into existing CDFs. Disposal of dredged material in CDFs is one of the most commonly considered alternatives for such material. CDFs are also an option considered for disposal of contaminated sediments dredged for purposes of sediment remediation. They are used as temporary rehandling sites or for final disposal. CDFs are also used for the disposal of clean sediments where other disposal options are too costly or present additional environmental problems (USACE 2003).

Figure 1 illustrates the various categories of CDFs. CDFs may be constructed as upland sites, nearshore sites (partial on-shore/off-shore design), or as island containment areas (Figure 1). CDFs vary considerably in size, dike design, and method of filling. CDFs are typically designed to retain solids while allowing water to be released through an overflow-weir and/or through semi-permeable dikes. CDFs are not solid waste landfills. They are designed and constructed specifically for disposal of dredged sediment, which has a high water content, and to return the flow of excess water as effluent to surface waters (USACE 2003). Over 30 CDFs now exist in the U.S. Great Lakes, with over twenty-five of these having been constructed with Federal funds.

CDFs constructed in water may become upland sites once the fill reaches elevations above the mean high water elevation. A true nearshore site will take advantage of the shoreline as a part of the containment structure for the site, with in-water dikes or other containment structures required only for the outer walls of the total enclosure. Island CDFs are similar to nearshore CDFs, except that they are constructed totally in water with no direct physical connection to the shore (USACE 2003).

Depending mostly on the elevation and frequency of dredged material disposal, dredged material in CDFs may develop into either aquatic, wetland or terrestrial-type habitats. A particular CDF may evolve through a succession of habitat types during its life. As sites are filled, aquatic habitat may be replaced by wetland and then terrestrial habitat. At any point in time, the portions of a single CDF near the inflow point may exhibit terrestrial habitat characteristics, which may shift to wetland habitat and then to aquatic habitat near the weir (USACE 2003).

A primary concern with CDFs is the potential for release of contaminants incorporated within the dredged material back into the environment. Potential pathways for contaminant release from CDFs include migration through or under the dikes, volatilization to the atmosphere, release with discharge water via the weir, and uptake by animals living or feeding in the facility. The purpose of this document is to evaluate the potential release pathways and to assess associated environmental and human health risks.

1.3 Dredged Material Management

The transport of dredged material to CDFs may be accomplished with hydraulic or mechanical means. Hydraulically dredged sediments may be conveyed to the facility with a pipeline from the hopper or cutterhead dredge. Mechanically dredged sediments may be transported to the facility and offloaded mechanically from a barge or the sediments may be converted to a slurry for hydraulic transfer to the disposal facility via pipeline.

Typically, CDFs are constructed with a designated off-loading site. With mechanically placed material, dredged sediment tends to accumulate near the offloading site. If the CDF is filled hydraulically, the discharge of the dredge slurry into the site is generally located away from the overflow weir and a sufficient amount of retention time allows for solids to settle, which translates into an acceptable effluent discharge. If the CDF is filled mechanically, the sediment is physically lifted and placed into the facility using a crane and clamshell bucket.

Early CDFs were designed to retain only solids and were not designed to be watertight. In some instances they were designed to be semi-permeable. CDFs were often constructed with gradations of stone in the dike walls. The outer face of the dike walls were required to have heavy armor stone to withstand forces created by wave action encountered on the Great Lakes. The interior face of the dike walls would also require some armoring to withstand wave action generated from the water body within the CDF. Various designs were used, including gradations of smaller stone that allow water to move through the dike but trap fine sediment. The fine sediment would presumably clog the dike as the CDF was filled, preventing further release of water through the dike.

USACE policy regarding the flow of CDF return water through the overflow weir into nearby surface waters is that it is a discharge regulated under Section 404(b)(1) of the Clean Water Act. This mandates that unacceptable adverse effects on the aquatic environment be avoided during in-water disposal of dredged material. Therefore, a point source discharge permit under Section 402 of the Clean Water Act, called a National Pollutant Discharge Elimination System (NPDES) permit, is not required.

2.0 POLLUTANTS

Sediment, soil and water samples from the Cleveland Harbor CDF 10B were collected to evaluate the potential for release of contaminants associated with the dredged material back into the environment. Generally, pollutants in Great Lakes dredged material may be divided into three main categories: chlorinated organic compounds (pesticides/polychlorinated biphenyls [PCBs], and dioxin), polycyclic aromatic hydrocarbons (PAHs), and heavy metals. Volatile organic compounds (VOCs) have also been detected in Great Lakes dredged materials, however, to a lesser extent than the three categories cited above. While other physical and chemical constituents are important to water quality in the Great Lakes, these pollutants are not as critical when evaluating dredged material being placed in a CDF. Samples were analyzed for one or more parameter groups from the Federal Priority Pollutant List (PPL, Section 307 of the Clean Water Act) to ensure that the three major groups of pollutants were comprehensively investigated. The PPL includes 129 compounds/analytes analyzed as volatiles, semi-volatiles, pesticides/PCBs, heavy metals, and cyanide. PAHs are a sub-parameter group of the PPL semi-volatile group. The following discusses the most likely PPL compounds/analytes to be detected in material that is dredged from the Great Lakes watershed.

2.1 VOCs

VOCs in general are organic compounds that evaporate readily into the air. VOCs include substances such as benzene, toluene, methylene chloride, and methyl chloroform. The loss of VOCs from sediments and dredged materials is a recognized environmental problem, and disposal and storage operations associated with dredged material placement in CDFs can result in VOC emissions.

Contaminant chemical properties such as Henry's Law Constant and vapor pressure are also very important in determining contaminant flux to air. Henry's Law states that chemicals with higher vapor pressures and low aqueous solubilities will tend to volatilize while chemicals with lower vapor pressures and higher aqueous solubilities will tend to dissolve in water. Environmental variables such as relative air humidity and temperature can also play a part in contributing to VOC loss. Volatile emissions pathways from CDFs can include releases from plant covered dredged material, exposed dredged material, ponded water, and from effluent released from the CDF.

The highest volatile contaminant transfer conditions are in the first few hours after the surface of the dredged material is exposed. After the initial drying of the surface occurs, the rate of volatile contaminant transfer is reduced to levels less than that for a ponded condition. Since ponded conditions can remain over dredged material in a CDF for considerable periods, the ponded condition is likely the most critical at most sites. Contaminant transport from in-situ dredged material to air is a relatively slow process because most contaminant should first be released to the water phase prior to reaching the air.

Currently, there are no known instances where volatiles from CDFs have posed a potential release sufficient enough to trigger the regulatory application of the Clean Air Act (CAA). Importantly, the CAA regulates volatile emissions from a point source (stack), and the CAA regulates only a few parameters such as particulates and carbon dioxide. Neither of these scenarios applies to CDFs. Nevertheless, there are occasions where workers can be exposed to volatile emissions while undertaking management actions at the CDF such as dike rehabilitation and dewatering activities.

2.2 Chlorinated Organic Compounds

2.2.1 PCBs

PCBs are mixtures of chlorine substituted biphenyl compounds. The structure of the compound consists of a biphenyl molecule with substitution of chlorine for the hydrogen on one to ten of the positions on the ring. Differing amounts of substitution and different positions of the chlorines leads to 209 possible compounds, termed congeners. If only the empirical formula is evaluated, the PCBs may be subdivided into ten PCB homologues. The different degrees of chlorination are noted by four-digit numbers after the trade name Aroclor, such as Aroclor 1242 or Aroclor 1260. With the exception of Aroclor 1016 (which is 41% chlorine), the last two digits of the four-digit term represent the percentage of chlorination by mass of the PCB mixtures. Homologous PCBs that only differ by position of the chlorine molecules are termed isomers.

PCBs in the aqueous phase may be sorbed to sediments or may be released to the atmosphere, depending on solubility, vapor pressure, mass transfer coefficients, and other congener specific characteristics. Solubility of PCBs is exceptionally low and this low aqueous solubility results in high partitioning coefficients to abiotic and biotic particles in sediments. Sorption is determined by the organic carbon content of the particles with the highest concentrations bound to organic carbon-rich, clay size particles (Eisenreich et al., 1989).

PCBs in soils will volatilize out of the soil depending on several properties, such as the organic content of the soil and nature of the surface. If water is not present, PCBs will move to the soil surface through simple diffusion. When water evaporates from the soil surface, an appreciable upward movement of water results through diffusion of water (Nottoli and Jacko, 1990).

Environmental PCBs are highly persistent, and quite resistant to biological or chemical degradation. Sediment-associated PCBs are usually quite bioavailable. Therefore, they tend to readily bioaccumulate in aquatic organisms and can biomagnify through the food web. They accumulate in fat tissue. The bioavailability of PCBs depends on factors such as the level and origin of organic carbon, hydrophobicity (octanol-water partition coefficient, log Kow) and degree of chlorination. Since PCB congeners have differing hydrophobicities and chlorinations, their individual bioavailability can differ significantly.

2.2.2 Pesticides

Several organochlorine pesticides such as dichlorodiphyenyltrichloroethane (DDT), dieldrin, mirex (or dechlorane), toxaphene, and chlordane have been detected in the Great Lakes (Leland et al., 1973, Stevens and Nelson, 1989, Sullivan and Armstrong, 1985, Oliver et al., 1989). They are persistent and generally resistant to biological or chemical degradation. Several pesticides have been demonstrated to have high carcinogenic potency, especially dieldrin and chlordane, and pose the greatest human health risk associated with consumption of Great Lakes fish (Bro et al., 1987).

Sediment-associated pesticides can be quite bioavailable. Therefore, they can also readily bioaccumulate in aquatic organisms and can biomagnify through the food web. The bioavailability of pesticides such as DDT and mirex depends on factors such as the level and origin of organic carbon, and hydrophobicity.

2.3 PAHs

PAHs consist of multiple benzene rings fused together in various arrangements. PAHs are ubiquitous pollutants in Great Lakes sediments and concentrations remain high despite efforts to curb releases. Because many different PAH compounds exist and because of extreme variations in toxicity and carcinogenicity, it is often difficult to determine the impacts of PAHs in sediments. Point and non-point sources account for the high PAH concentrations often seen in dredged material. PAHs as a group are hydrophobic compounds, however there is wide variation in solubility, biodegradability, and toxicity within the group. The PAHs identified by the Environmental Protection Agency as priority pollutants are identified in Table 1. PAHs have higher water solubility than PCBs and their behavior in the water column appears to be dominated by solubility. Low molecular weight PAHs containing 2-3 benzene rings are highly susceptible to volatilization, photolysis, and biodegradation pathways and are rapidly removed from the water column.

When compared to PCBs and pesticides, PAHs can be degraded in the aquatic environment and are much less persistent. Sediment-associated PAHs are usually less bioavailable when compared to PCBs and pesticides, and show an overall relatively low potential to bioaccumulate. Nevertheless, they can bioaccumulate in aquatic organisms and are often metabolized into other compounds, some of which can be more toxic than the parent compound. PAHs usually do not biomagnify through the food web. Their bioavailability depends on factors such as the level and origin of organic carbon, and the hydrophobicity (octanol-water partition coefficient, log Kow) and molecular size of the compound. The bioavailability of PAH compounds can differ substantially.

2.4 Dioxins

Dioxins are classified as halogenated aromatic hydrocarbons. The most notably studied congener is 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8- TCDD). As the most toxic congener, it is often referred to simply as dioxin and is the reference for a number of compounds that are similar structurally and have dioxin-like toxicity. Dioxins have no commercial usefulness by themselves, and are trace impurities formed during the manufacture, chlorination, or combustion of other organic compounds.

Dioxins are comprised of over 200 congeners. In general, dioxins have low water solubility and low vapor pressure, and many are very stable. Compounds in these families will have differing properties, depending on the number and position of chlorine atoms in the molecule.

Dioxins are ubiquitous and can be found in a wide range of environments and organisms, though normally in very low concentrations. The persistent and hydrophobic nature of dioxins causes them to accumulate in soils, sediments, organic matter and waste disposal sites. Disturbance of these sites (e.g. such as dredging) may re-release the dioxins. In some animals, dioxins are highly toxic, cause cancer, and alter reproductive development and immune function. They tend to be toxic at very low concentrations and the effects of exposure are often delayed. However, the toxicological effects of dioxins can vary dramatically from species to species. Dioxins are quite resistant to biological or chemical degradation. Sediment-associated dioxins are generally bioavailable and they tend to readily bioaccumulate in aquatic organisms. While dioxins are very slowly eliminated from organism tissues, evidence for biomagnification through the food web is limited. The bioavailability of sediment-associated dioxins depends on factors such as the level of total organic carbon and hydrophobicity. Since the congeners have differing hydrophobicities, their individual bioavailability can differ.

2.5 Metals

Concentrations of metals have been correlated with toxicity at several locations on the Great Lakes (Geisy, 1988) and metal induced toxicity was probably one of the main factors in the initiation of the CDF program. Several metals are included in the priority pollutant list (Table 2). In dredged material and soils metals are typically strongly bound to the soil particles and will resist release.

While metals can exert acute and chronic toxicity, they are generally regarded to be less or non-bioaccumulative. However, some metals such as cadmium and mercury, often do bioaccumulate, and mercury can even biomagnify in the food web. Methyl mercury is the most bioavailable form of mercury. There is no well-established relationship between the levels of metals in sediments and those which are bioaccumulated in aquatic organisms. Therefore, higher levels of metals in sediments are not necessary indicative of what could potentially bioaccumulate.

3.0 POTENTIAL CDF CONTAMINANT EXPOSURE PATHWAYS

Contaminant migration pathways are routes by which contaminants or constituents of concern (COCs) associated with dredged material contained in CDFs may move from the dredged material within the site into the environment outside the facility (USACE 2003). The possible pathways from an upland CDF are illustrated in Figure 2. These six pathways include:

1. Effluent discharges to surface water during filling operations and subsequent settling and dewatering.
2. Precipitation to surface runoff.
3. Leachate into ground water.
4. Volatilization to the atmosphere.
5. Direct uptake by plants growing on the dredged material (plant bioaccumulation).
6. Direct uptake by animals living on the dredged material and subsequent cycling through food webs (animal bioaccumulation).

Pathways for a **nearshore** CDF are illustrated in Figure 3. These routes include a number of pathways that are also considered for upland CDFs. However, the relative importance of pathways for a nearshore CDF differs from an upland CDF. A primary advantage of the nearshore CDF is that contaminated dredged material may remain within the saturated zone so that anaerobic conditions prevail and contaminant mobility is minimized. A disadvantage is that exterior water level fluctuations may cause a pumping action through the exterior dikes, which are generally constructed of permeable material. This pumping action increases the exchange of ponded water from the CDF and increases convection of soluble contaminants from the facility. Soluble contaminants are present in the ponded water by diffusion from the settled dredged material or by expulsion of contaminated pore water from consolidating dredged material. The pumping action may result in soluble convection through the dike in the partially saturated zone and soluble diffusion from the saturated zone through the dike. Pumping action, however, is experienced primarily in CDFs that contain large-grained sediments such as sands and gravels, and is less predominant in those CDFs that contain fine-grained materials such as clays, silts, and fine sands due to the low permeability of these materials.

Pathways for **island** CDFs would be similar to nearshore sites. That portion of a nearshore or island CDF raised to above the mean high water elevation will essentially function as an upland CDF.

Effects on surface water quality, ground water quality, air quality, plants and animals depend on the characteristics of the dredged material, management and operation of the site during and after filling, and the proximity of the CDF to potential contaminant receptors.

4.0 CLEVELAND HARBOR AND CDF 10B

4.1 Location

Cleveland Harbor is located in Cuyahoga County, Ohio at the mouth of the Cuyahoga River, on the south shore of Lake Erie, approximately 176 miles west of Buffalo, New York and 96 miles east of Toledo, Ohio. The Cleveland Harbor Dike CDF 10B is an in-water, nearshore facility. It is located in Cleveland Harbor, on the west side of the existing Dike 13 CDF, adjacent to the Burke Lakefront Municipal Airport (Figure 4).

4.2 Site Features and Characteristics

The City of Cleveland is located at the mouth of the Cuyahoga River as it enters Cleveland Harbor. Because of its location and transportation facilities, Cleveland has become an important center of industry and commerce. Commodities that move through the harbor include limestone, iron ore, cement, sand, gravel, salt, oil, grain, and general cargo. Land use in the Cleveland Harbor area is generally a mix of industrial, commercial, transportation, recreational, with some residential.

Federal navigation channels in Cleveland Harbor include those in the Outer Harbor, and the Old River and the Cuyahoga River Channels (Inner Harbor). The Cleveland Lakefront Harbor extends for a distance of approximately five miles along the shoreline and varies in width from approximately 1,600 to 2,400 feet. The Entrance Channel into the harbor is provided through either the dredged channel between the arrowhead breakwaters (the main or west entrance) or between the eastern end of the east breakwater and the shore (the east entrance). The Inner Harbor includes improved navigation channels on the lower 5.8 miles of the Cuyahoga River and about one mile of the Old River, the former outlet of the Cuyahoga River. Widths in the navigation channels vary from 100 to 325 feet, except at the river bends and in the existing turning basin in the Cuyahoga River where a width of 800 feet is available.

The Cleveland Harbor CDF 10B was constructed in 1998 at a cost of $32,900,000. An Environmental Impact Statement (EIS) dated March 1994 discussed the environmental effects of the project and weighed CDF construction alternatives. The dike design consists of a graded stone core with layered coverstone protection. Navigation projects served by the CDF are dredging of the Federal navigation channels of Cleveland Harbor, as well as dredging by some non-Federal interests. In order to maintain authorized depths in the Federal navigation channels, the USACE must conduct periodic dredging within the Cuyahoga River and Cleveland Harbor. Dredged quantities vary each year but have averaged approximately 300,000 cubic yards per year. The facility occupies an area of approximately 68 acres and has a total capacity of 3,840,000 cubic yards (USACE and USEPA 2003).

Transport of dredged material to the CDF may be accomplished with hydraulic or mechanical techniques. Hydraulically dredged sediments may be conveyed to the CDF with a pipeline from the dredge hopper while mechanically dredged sediments may be transported to the facility and offloaded mechanically or may be converted to a slurry for transfer to the facility by pipeline. Dewatering of the dredged material is accomplished by seepage through the dike walls and by discharge through an overflow weir into Lake Erie. Treatment of the effluent is achieved through primary settling and filtration through the dike wall. No water quality monitoring is required. The intended post-closure use of the CDF is for expansion of the Burke Lakefront Municipal Airport.

Buffalo District USACE personnel conducted a site visit of the CDF in May of 2004. During this visit, visible evidence of waterfowl, and other avian species was observed on site. However, due the proximity of the Cleveland Harbor CDF 10B to the Burke Lakefront Airport, an aggressive wildlife control program is continuously ongoing at this facility. The presence of terrestrial and avian wildlife species in the area can be detrimental to the operation of the airport, particularly the take-off and landing activities of aircraft. Habitat types dominating the CDF include open-water, emergent wetland, and old-field.

4.3 Initial Identification of Receptors of Concern

Receptors of concern are considered to be ecological receptors, and/or humans outside of the CDF, who might be exposed to contaminants associated with the dredged material. One consideration in determining receptors of concern is current and potential future land use, including surrounding land use. Receptors of concern identified for Cleveland Harbor CDF 10B include dredging workers, wildlife control workers, and various wildlife, primarily waterfowl and other avian species.

The CDF does not constitute a unique fishery resource, nor is it an important fish spawning ground. No potential presence of Federally threatened and/or endangered (T&E) species or their critical habitat is expected in the CDF based on the current habitat present at the site and the distribution of known T&E species in Ohio.

5.0 TIER I - IDENTIFICATION OF POTENTIAL CONSTITUENTS OF CONCERN AND POTENTIAL RECEPTORS AND EXPOSURE PATHWAYS OF CONCERN

5.1 Methodology

Constituent screening evaluations have been conducted on media (soil, sediment and water) contained within and around Cleveland Harbor CDF 10B, to determine its potential toxicity, and determine the potential level of risk it may pose to off-site receptors such as humans, and terrestrial and aquatic biota. For the purposes of this screening, it was determined that the use of Federal screening levels or, where applicable, reference area sediment, soil, or water concentrations, would be the most appropriate approach. The choice of screening values depends on the nature of the constituents of potential concern, the receptors of potential concern, as well as the exposure pathway(s).

5.2 Available Data

Samples were collected from Cleveland Harbor CDF 10B media in 2004 and analyzed for organic and inorganic constituents, including VOCs, PAHs, PCBs, pesticides, metals, base neutral and acid extractable compounds (BNAs), cyanide, and dioxin, to complete the analysis of CDF media according to the priority pollutant list. Media sampled included soils and sediments (and corresponding leachate), ponded water within the dike, water just outside the dike, and lake water. Results of these analyses are found in Appendix A.

Only those analytes found on the priority pollutant list are considered in this evaluation. For example, we have results for metals such as aluminum, barium, and calcium. Since these analytes are not part of the priority pollutant list, they will not be presented here.

5.3 Exposure Pathways

A preliminary conceptual site model for a Tier I evaluation of Cleveland Harbor CDF 10B, identifying the source of contaminants, migration and exposure pathways, and receptors and standards, is shown in Figure 5. This conceptual site model is based upon the six pathways of concern identified in the USACE *Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities – Testing Manual* (UTM), which are listed and described in Section 3 (USACE 2003). The complete exposure pathways to be examined in this Tier 1 analysis are: (1) volatilization from sediments and soils to air, and inhalation by workers or people visiting the site for recreational purposes, (2) rainfall, partitioning to water and surface water accumulation in an interior pond, with subsequent exposure to aquatic organisms within the pond, (3) bioaccumulation of constituents within the pond by fish, and consumption by piscivore birds who visit the CDF, (4) bioaccumulation of constituents from sediments and ponded water by waterfowl, and consumption by people hunting at the CDF, (5) bioaccumulation of constituents from soils by soil invertebrates, and consumption by birds and small mammals at the CDF, (6) root uptake of metals from the soils and sediments, and ingestion of the plants by rabbits, deer, and people hunting at or near the CDF, and (7) direct contact of contaminated soils by people who work at the CDF.

Complete exposure pathways which link the source of constituents with receptors of concern include inhalation of volatiles, surface water runoff to an interior pond, plant uptake of metals, animal uptake of organic constituents, and direct contact with constituents in the soils and sediments. The remaining two pathways, release of discharge of water via the weir, and migration of constituents through or under the CDF dikes, are being eliminated from further consideration for the following reasons: (1) Discharge of effluent water is not a current concern, since the dredged sediment ponds are currently contained by the dike. In the future, when the dredged sediments reach the dike level and release of effluent may be necessary through the overflow weir, then this exposure pathway will have to be re-examined to ensure that surface water quality standards are not exceeded; and (2) Leaching of constituents through or under the dike to the lake is not a concern for this in-water CDF. As stated in section 6.1 of the UTM, leachate that passes through dredged material and directly enters surface waters is not generally a concern with regard to water column impacts, since the rate of flow of leachate is so low and the leachate would be mixed and diluted to background levels almost immediately. Leachate reaching groundwater and then rising to surface water is not addressed in this UTM (USACE 2003).

Five main categories were developed for the purposes of the screening, which encompass all of the exposure pathways identified on the conceptual site model (Figure 5).

a. *Comparison with Reference or Background Levels* – Since the main objective of this evaluation is to determine whether or not constituents from the CDF are being released into the environment at levels that could pose an unacceptable risk to outside receptors, it is appropriate to distinguish concentrations of constituents within the CDF from ambient levels of constituents. The background level of constituents is typically considered at USACE hazardous, toxicological, radiological waste sites (HTRW), which use the USEPA's Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and related documents, such as the National Oil and Hazardous Substances Contingency Plan (NCP), as guidance for investigations, risk assessments, and remedial actions. Although CERCLA does not apply to these CDF evaluations, the USEPA guidance document, "Role of Background in the CERCLA Cleanup Policy" (USEPA 2002a) may be helpful in deciding whether or not background should be considered when risk management concerns are considered for the CDFs. For example, the following definition of background is offered (USEPA 2002a):

> *Background refers to constituents or locations that are not influenced by the releases from a site, and is usually described as naturally occurring or anthropogenic. Anthropogenic refers to natural and man-made substances present in the environment as a result of human activities (not specifically related to the CERCLA release in question). Naturally occurring refers to substances present in the environment in forms that have not been influenced by human activity.*

Although the USEPA recommends that background levels of constituents be accounted for in the risk characterization of a site, it is acknowledged that where background concentrations are high relative to the concentrations of released hazardous pollutants, a comparison of site and background concentrations may help risk managers make decisions concerning appropriate remedial actions (USEPA 2002a). Furthermore, the

NCP outlines criteria for determining whether or not a substance has been released into the environment, which is a determination that needs to be made as part of these CDF evaluations (NCP 1990).

> *The minimum standard to establish an observed release by chemical analysis is analytical evidence of a hazardous substance in the media significantly above the background level. Further, some portion of the release must be attributable to the site.*

In 1997 and 2004, constituents were measured in the water ponded within the dike, just outside the dike, and at lake reference areas. These concentrations were compared to one another to determine whether or not the constituents may be leaking through the dike at elevated amounts, or, whether or not the constituents in the ponded water within the dike are elevated relative to reference lake levels (Table 3). In addition, comparisons were made to concentrations of constituents in background soils or sediments, whenever appropriate data was available (Table 4). Concentrations of PAHs and metals in lake reference sediments, measured in 2002, were compared to concentrations of PAHs and metals in sediments within the CDF (Table 5).

b. *Direct Human Contact with Soils/Sediments* – For direct human contact with the soils and sediments, USEPA Region IX Preliminary Remediation Goals (PRGs) have been used to screen the sediment and soil sample results (USEPA Region IX 2002). The PRGs are risk-based concentrations, developed by the USEPA, Region IX, and are used routinely during site inspections of hazardous wastes sites by USACE risk assessors. These PRGs were developed to address two different types of human receptors: residents and workers. As stated earlier, potential human receptors at CDF 10B include workers. When soil or sediment sample results exceed both the residential and the industrial PRGs, then further evaluation is warranted (Table 6).

This comparison to PRGs includes a consideration of inhalation of VOCs from soils and sediments. The exposure assumptions used to develop the PRGs are more conservative and protective of human health for this situation, than the assumptions used in developing the OSHA air standards. Therefore, an additional comparison to OSHA air standards is not necessary.

c. *Uptake by Biota* – To determine if the material in the CDF might pose the potential for risk to humans or wildlife due to biota uptake, concentrations of constituents in the soils and sediments were compared to biosolids criteria found in USEPA Rule 503 (Federal Register 1997) (Table 7). Biosolids are the nutrient-rich organic materials resulting from the treatment of sewage sludge (the name for the solid, semisolid or liquid untreated residue generated during the treatment of domestic sewage in a treatment facility). When treated and processed, sewage sludge becomes biosolids, which can be safely recycled and applied as fertilizer to sustainably improve and maintain productive soils, and stimulate plant growth. The biosolids rule established pollutant limits in biosolids when the biosolid is applied to agricultural lands, as well as the resulting soil concentration. This comparison is appropriate because the biosolids limits were established as a result of a risk assessment that included ingestion of crops grown in the biosolid-amended soil (which is relevant for exposure to metals), as well as ingestion of animals that have direct ingestion of biosolid-amended soils (which is relevant for exposure to organic compounds). The most limiting exposure pathway was used to set the criteria concentrations (USEPA 1993).

d. *Aquatic Organism Exposure* – The presence of the ponded surface water at Cleveland Harbor CDF 10B necessitates a screen for protection of aquatic organisms. This was achieved by screening sediment concentrations against consensus threshold effects concentrations (TEC) and probable effects concentrations (PEC) listed in Table 8 (USEPA 2002b), as well as screening concentrations of constituents in ponded water, against national water quality criteria (USEPA 2004), which are listed in Table 9.

The consensus TECs were developed to represent concentrations of individual constituents, below which the constituent was considered to be non-toxic in the sediment. The consensus PECs were developed to represent concentrations of individual constituents, above which the constituent was considered to be toxic. The consensus effects concentrations were validated with toxicity tests (USEPA 2002b). These studies indicated that most of the TECs provide an accurate basis for predicting the absence of sediment toxicity. Similarly, most of the PECs provide an accurate basis for predicting sediment toxicity. The use of these consensus based sediment quality guidelines in a Tier I screen to identify contaminants which may be subject to higher tier effects-based testing is consistent with earlier recommendations by the USACE (USACE 1998). These sediment quality guidelines should not be the sole source of information used in making decisions regarding management of dredged material.

Aquatic life water quality criteria, from the National Recommended Water Quality Criteria (Section 304[a]), contain two criteria; a criteria maximum concentration (CMC), and a criteria continuous concentration (CCC) (USEPA 2004). The CMC is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed briefly without resulting in an unacceptable effect. The CCC is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect. Because 304(a) aquatic life criteria are national guidance, they are intended to be protective of the vast majority of the aquatic communities in the United States.

e. *Human Consumption of Aquatic* Organisms – Although the CDF is posted and fishing and hunting are not allowed or encouraged from or within the CDF, trespassing still occurs and people may consume fish or aquatic birds that live or feed within the CDF. Humans may hunt waterfowl that feed within the CDF. The USEPA, in its National Recommended Water Quality Criteria (Section 304[a]), has also developed guideline concentrations to protect humans who may consume organisms from surface water, as well as the surface water itself (USEPA 2004). Since municipal water supplies are readily available in the area of the CDF, it is assumed that the CDF water is not used as a source of drinking water. Therefore, the water quality criteria used for this evaluation are not those that are protective for people consuming both the water and organisms from the water; they are protective for people consuming aquatic organisms only. Although consumption of waterfowl is not directly assessed in the development of the water quality criteria, comparison with these criteria may give an indication of the potential for unacceptable risk to humans who may hunt and consume waterfowl from this CDF. The comparison between concentrations of constituents in ponded water in Cleveland Harbor CDF 10B and the human health water quality criteria is made in Table 10.

5.4 Constituent Specific Screening

Details on the results of screening the data are discussed below.

5.4.1 VOCs:

a. *Comparison to Background* - Five VOCs (1,4-dichlorobenzene, benzene, chlorobenzene, ethylbenzene, and toluene) were detected in soil and sediment samples taken in the CDF, but no VOCs were detected in Cleveland Harbor CDF 10B surface water (Appendix A). VOCs are not expected to exist in background soils and sediments, so any VOCs detected would be considered elevated above background. In general, the sediment concentrations of VOCs are greater than the concentrations of VOCs in soils, so the presence of surface water in CDF 10B may be inhibiting volatilization from dredged material in the facility. Although dredged material is placed into the CDF on a yearly basis, it is not clear why the VOCs would persist in soils and sediments if they originated from the dredged sediments. These VOCs did not appear in Cleveland Harbor Dike14 CDF 1997 sample analysis, although PCE, methylene chloride, and xylene were detected in the 1997 soil samples. The presence of BTEX compounds in the Cleveland Harbor CDF 10B suggests a nearby source, such as aviation fuel from the nearby airport. (Xylene is not part of the priority pollutant list, so it was not analysed for during the 2004 sampling and analysis event.)

b. *Direct Human Contact with Soils/Sediments* – None of the five VOCs detected in CDF 10B soils and sediments are at concentrations that exceed their respective PRGs (Table 6). Therefore, these five VOCs would not pose an unacceptable risk via direct human contact with soils or sediments in Cleveland Harbor CDF 10B.

c. *Uptake by Biota* – Because of their physical properties, VOCs are typically not a bioaccumulation concern. No biosolids criteria (USEPA Rule 503) have been developed for VOCs.

d. *Aquatic Organism Exposure* – No National Recommended Water Quality Criteria for the protection of freshwater aquatic organisms have been developed for VOCs[1]. No sediment consensus effects concentrations have been developed for VOCs. However, secondary surface water quality criteria do exist for VOCs, which, along with equilibrium partitioning calculations, may be used to screen these sediment concentrations of 1,4-dichlorobenzene, benzene, chlorobenzene, ethylbenzene, and toluene. The Tier II

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[1] For most organic constituents (other than pesticides), the EPA has not developed water quality criteria for the protection of aquatic life. The water quality criteria established for these organics is only aimed at protection of humans.

chronic values for protection of aquatic life were converted to a sediment quality criterion, using octanol-water partitioning (Suter and Tsao 1996). These were normalized against organic carbon content, to develop a site-specific sediment screening criteria for Cleveland Harbor CDF 10B that would be protective of aquatic life potentially exposed to the CDF sediments. As seen in Table 8a, the derived sediment quality criteria are greater than maximum detected concentrations of all the VOCs detected in Cleveland Harbor CDF 10B sediments. Therefore, it is concluded that VOCs in CDF 10B sediments are not present in levels that could pose a risk to aquatic organisms.

e. *Human Consumption of Aquatic Organisms* – No VOCs were detected in ponded water in Cleveland Harbor CDF 10B. The detection limits reported by the laboratory for the five VOCs that were detected in soils and sediments are less than the water quality criteria for human consumption of aquatic organisms (Table 10). Therefore, VOCs do not pose a risk to humans that may consume aquatic organisms from Cleveland Harbor CDF 10B waters.

f. *Conclusions for VOCs*: Although five VOCs were detected in Cleveland Harbor CDF 10B soils and sediments, they are not present in concentrations that would pose a risk to human health or ecological receptors, for any of the complete exposure pathways identified for this CDF. No further evaluation of VOCs is necessary.

5.4.2 Metals:

a. *Comparison to Background* – To determine whether or not metals exist at elevated concentrations within the CDF, a comparison of average CDF metal concentrations with concentrations of metals from reference areas was made (Table 4). These sediment reference values were published by the Ohio EPA (OEPA, February 2003). The concentrations of most metals in Cleveland Harbor CDF 10B sediments were above the Ohio sediment reference values. The average sediment concentrations of cadmium, copper, and zinc were all over twice the Ohio sediment reference values.

Many sediment metal concentrations were also above lake reference sediment concentrations (Table 5), but the level of exceedances was in general not as great as the exceedances of the Ohio sediment reference concentrations (Table 4).

The concentrations of most metals in the ponded water in the CDF are also higher than corresponding metal concentrations in lake background water (Table 3). The concentration of lead is almost 10 times higher in the ponded water than in the lake water.

b. *Direct Human Contact to Soils/Sediments* – The levels of arsenic in both soils and sediments exceeded both the residential and the industrial PRG (Table 6); however, arsenic was one of the few metals that did not exceed Ohio sediment reference values (Table 4). No other metal concentrations exceed their respective PRGs. Therefore, metals are not a direct contact hazard for humans.

c. *Uptake by Biota* – To determine whether or not these metals might pose a risk to humans or wildlife due to the plant uptake pathway, concentrations of metals in the soils and sediments were compared to biosolids criteria found in USEPA Rule 503. The soil and sediment concentrations of all metals are below biosolids criteria, with the exception of arsenic (Table 7). Although the concentration of arsenic in soil is below the biosolids criteria, the sediment concentrations of arsenic are above the biosolids criteria. However, the arsenic a biosolids criterion was developed based on direct consumption of biosolids by a child, not via plant or animal uptake and subsequent human exposure. The risk assessment used to develop the biosolids criteria also looked at plant and animal uptake for arsenic. If these pathways were used to set the biosolids criteria (rather than the limiting pathway of direct ingestion), then the biosolids criteria would be much higher than the sediment concentrations of arsenic (USEPA 1993). Nevertheless, the biosolids rule does not assess environmental effects of the presence of metals; rather, it focused on exposures to people. Therefore, comparison of metal concentrations to the biosolids limits would not indicate whether or not the plants themselves, or herbivores that visit the CDF, would be at risk due to metal concentrations in the soils or sediments. As several metals were identified as being significantly above background or reference values, further evaluation of this pathway is warranted, since there is currently not enough information available to eliminate this pathway from concern.

d. *Aquatic Organism Exposure* – The maximum and average sediment concentrations of several metals exceed the consensus TECs (Table 8). However, none of the sediment metal concentrations exceed the consensus PECs. Therefore, based on this screening, it is unlikely that metal concentrations in the Cleveland Harbor CDF 10B sediments have the potential to pose an unacceptable risk to aquatic organisms.

Surface water concentrations from within the CDF were also compared to the National Recommended Water Quality Criteria, for protection of freshwater aquatic organisms (Table 9). Only lead in CDF 10B ponded water exceeded the CCC water quality criteria for aquatic life. However, the concentration of lead in ponded water did not exceed the CMC. Therefore, based on this screening, it is unlikely that the metal concentrations in Cleveland Harbor CDF 10B ponded water have the potential to pose an unacceptable risk to aquatic organisms.

e. *Human Consumption of Aquatic Organisms* – Water quality criteria for the protection of human health have only been developed for a few metals (Table 10, USEPA 2004). The only metal that exceeded its respective water quality criteria was arsenic. However, the water quality criterion for arsenic was established at a cancer risk level of one in one million (10^{-6}) excess incremental lifetime cancers. The upper threshold for an acceptable cancer risk is one in ten thousand (1E-04) (NCP 1990). USEPA and USACE use an acceptable cancer risk range of 1 in 1 million to 1 in ten thousand for their HTRW sites. As noted in USEPA 2002c, footnote to the arsenic criterion, "Alternate [cancer] risk levels may be obtained by moving the decimal point (e.g., for a risk level of 10^{-5} move the decimal point in the recommended criterion one place to the right." The concentration of arsenic in ponded water does not exceed 100 times the arsenic criterion, so the level of arsenic in ponded water would not likely an unacceptable risk via the fish ingestion pathway.

The potentially complete exposure pathway of concern is human consumption of waterfowl that feed at the CDF. Consumption of waterfowl is not directly assessed in the development of the water quality criteria. However, due the proximity of the CDF to the Burke Lakefront Airport, an aggressive wildlife control program is continuously ongoing at this facility. It is unlikely then that a robust waterfowl population would be sustained at CDF. Because arsenic does not have a high potential for bioaccumulation, and because this is only a marginally complete exposure pathway, no further evaluation of this pathway is warranted.

f. *Conclusions for Metals* – Several metals may be elevated relative to background or reference sediment values. Although these metals are not elevated enough to act as potential constituents of concern for some of the relevant exposure pathways (direct human contact, aquatic organism exposure, or human consumption of aquatic organisms), there is not enough information to eliminate the biota uptake pathways from further consideration. Therefore, additional evaluation of metal bioaccumulation, especially via plant uptake, is warranted.

5.4.3 PAHs:

a. *Comparison to Reference or Background* – Levels of PAHs from Cleveland Harbor CDF 10B sediments were compared to PAH concentrations in lake reference sediments, as measured during a 2002 sampling event of river, harbor, and lake reference sediments. As can be seen in Table 5, most PAHs within CDF sediments are greater than lake reference sediments.

b. *Direct Human Contact* - The soil and sediment concentrations of most PAHs are below their respective PRGs (Table 6). The soil concentration of benzo (a) pyrene exceeds the residential PRG, but not the industrial PRG. The maximum and average concentrations of benzo(a)pyrene in the sediments exceed both the residential and industrial PRG for benzo(a)pyrene. However, the PRGs were developed based on extensive direct exposure to soils, not sediments. Because the industrial PRG for benzo(a)pyrene is not exceeded in soil (only in sediments, which would not have as much exposure in an industrial land-use), and the most likely future use of Cleveland Harbor CDF 10B is for industrial use (airport expansion), PAHs in soils do not pose a hazard via direct human contact.

c. *Uptake by Biota* – As non-polar organics, PAHs may have the potential to bioaccumulate, although probably not to the same extent as chlorinated hydrocarbons. This is due to the ability of most organisms to at least partially metabolize PAHs and excrete some of the PAH residues.

To evaluate the potential for PAHs to bioaccumulate, the concentrations of PAHs were compared to criteria established in the biosolids USEPA Rule 503. As seen in Table 7, a biosolids limit of 15 ppm has been established for benzo(a)pyrene. This limit is greater than the maximum detected concentration of benzo(a)pyrene in Cleveland Harbor CDF 10B soils or sediments. No corresponding soils concentration limit has been established. The 15 ppm limit was established based on the limiting exposure pathway in the biosolids risk assessment, which, for benzo(a)pyrene, was determined to be direct ingestion of biosolids by a child (USEPA 1993). No limit for benzo(a)pyrene was established based on plant to animal uptake, or direct animal uptake from contaminated soils, because these pathways were determined to have minimal risk during a screening, or hazard ranking, phase of the risk assessment (USEPA 1993).

Dredged sediment and the resulting consolidated soils would have significantly less organic carbon content than biosolid-amended soils, which should make organic contaminants more bioavailable (and hence more toxic) from dredged sediments than biosolid-amended soils. Therefore, comparison to the USEPA Rule 503 limits alone may not be enough information to conclude that PAHs do not pose the potential for unacceptable risk due to the animal uptake pathway.

Another line of evidence which may be used to determine whether or not levels of PAHs in Cleveland Harbor CDF 10B soils and sediments would bioaccumulate to adverse levels in wildlife visiting the site, is the comparison of PAH concentrations at the CDF, with PAH concentrations at Times Beach CDF. The Times Beach CDF has been extensively studied in the past, and conclusions may be inferred by making use of the data collected at this Lake Erie CDF (Stafford et al 1991, USACE-LRB 2003). A comparison of the concentrations of PAHs at Times Beach and CDF 10B can be seen in Tables 11 – 12. In addition, the concentration of total organic carbon (TOC) at the two sites was also compared, since TOC may affect the bioavailability of PAHs.

As can be seen in Table 11, average PAH levels in Times Beach oxidized soils are approximately 10 times higher than PAH levels in Cleveland Harbor CDF 10B oxidized soils. Average TOC levels at Times Beach are only approximately 2 times higher than TOC levels at CDF 10B. Therefore, it is likely that PAHs are less bioavailable from the CDF oxidized soils than Times Beach oxidized soils.

The levels of PAHs were measured in tissues of animals and birds caught at Times Beach (Stafford et al. 1991). The levels of PAHs in the Times Beach tissues were all below detection limits, between 0.3 to 1 ppm wet weight. (Although, this study of tissue levels of contaminants did not include an examination of insectivores, such as woodcocks, robins, or shrews, which would have the most direct contact to earthworms.) Most bird and animal species at Times Beach appear to be thriving.

As seen in Table 12, average levels of PAHs in reduced soils at Times Beach are about 10 times higher than PAHs in Cleveland Harbor CDF 10B reduced soils. Average TOC levels in reduced soils at Times Beach are approximately the same as average TOC levels from reduced soils at CDF 10B.

Since PAH levels at Times Beach were not apparently causing overt risk to ecological populations at Times Beach (USACE-LRB 2003), it is unlikely that the much lower levels of PAHs in Cleveland Harbor CDF 10B have potential for causing adverse ecological risks either.

d. *Aquatic Organism Exposure* – In the Cleveland Harbor CDF 10B sediments, four PAHs had maximum sediment concentrations that exceeded the consensus TEC (Table 8). The average concentration of benzo(a)pyrene also exceeded its consensus TEC. None of the consensus PECs were exceeded. Furthermore, none of the PAHs were detected in ponded water in CDF 10B. Therefore, it is unlikely that Cleveland Harbor CDF 10B ponded water contains PAHs at levels that would have the potential to pose an unacceptable risk to aquatic organisms.

e. *Human Consumption of Aquatic Organisms.* Water quality criteria have been developed for the protection of human health (via consumption of aquatic organisms) for PAHs, and are presented in Table 10. No PAHs were detected in ponded water in CDF 10B, at detection limits that exceed the water quality criteria for many PAHs (Table 10). Therefore, the water quality criteria cannot be directly compared to water concentrations of PAHs. Rather, equilibrium partitioning was performed, using published octanol-water partitioning coefficients (Kow) and measured fraction organic carbon in Cleveland Harbor CDF 10B sediments, to estimate the water concentrations that would exist above sediment concentrations of PAHs. As seen in Table 10a, the estimated water concentrations of these PAHs are all below water quality criteria for PAHs, with the exception of chrysene.

The potentially complete exposure pathway of concern is human consumption of waterfowl that feed at the CDF. However, due the proximity of the Cleveland Harbor CDF 10B to the Burke Lakefront Airport, an aggressive wildlife control program is continuously ongoing at this facility. It is unlikely then that a robust waterfowl population would be sustained at CDF. Because most PAHs passed the screen (particularly the more toxic PAHs such as benzo(a)pyrene, benzo(a)anthracene, and benzo(b)flouranthene), and because this is only a marginally complete exposure pathway, no further evaluation of this pathway is warranted.

f. *Conclusions for PAHs.* Several PAHs are elevated above lake reference concentrations. However, these PAHs are not elevated enough to act as potential constituents of concern for any of the potentially complete exposure pathways at this CDF. Therefore, no further evaluation of PAHs is warranted.

5.4.4 Pesticides

a. *Comparison to Reference or Background* – A comparison of DDT/DDD/DDE in Cleveland Harbor CDF 10B sediments to lake reference concentrations of sediments indicates that the detection limits for these compounds was comparable for samples from both locations. Although DDT/DDD/DDE were not detected in CDF sediments, they were measured above detection limits in soil samples taken from the CDF. However, the total levels of DDT/DDD/DDE in CDF soils are comparable to the total levels of these pesticides detected in lake reference sediments. Therefore, as the CDF concentrations are not above a lake background, no further evaluation of DDT/DDD/DDE for aquatic pathways from CDF 10B is warranted.

b. *Direct Human Contact* – The levels of DDT and DDE detected in Cleveland Harbor CDF 10B sediment are below residential PRGs (Table 6). Therefore, pesticides do not pose a risk via direct human contact with sediments.

c. *Uptake by Biota* – To evaluate the potential for pesticides to bioaccumulate, the concentrations of pesticides were compared to criteria established in the biosolids USEPA Rule 503. As seen in Table 7, the levels of pesticides in Cleveland Harbor CDF 10B sediments are less than the biosolids rule for these pesticides.

Dredged sediment and the resulting consolidated soils would have significantly less organic carbon content than biosolid-amended soils, which should make organic contaminants more bioavailable (and hence potentially more toxic) from dredged sediments than biosolid-amended soils. Therefore, comparison to the USEPA Rule 503 limits alone may not be enough information to conclude that pesticides do not pose the potential for unacceptable risk due to the animal uptake pathway. Furthermore, the limiting pathway in the risk assessment used to establish the biosolids limit for DDT and DDE was via fish ingestion, not animal bioaccumulation directly from soils. Therefore, there is not enough information to eliminate the animal bioaccumulation pathway for pesticides at Cleveland Harbor CDF 10B. Further evaluation of this pathway may be warranted.

d. *Aquatic Organism Exposure* – The maximum and average sediment concentration of DDT in CDF 10B exceeds the sediment consensus TEC, but not the sediment consensus PEC (Table 8). The sediment concentrations of DDE are lower than the sediment consensus TEC.

The concentration of DDE and DDT in ponded water at CDF 10B are below the limits of detection. The detection limits for DDT in water are greater than the CCC, but not the CMC (Table 9). Therefore, it is unlikely that concentrations of pesticides in Cleveland Harbor CDF 10B pose a risk to aquatic organisms. No further evaluation of this pathway is warranted.

e. *Human Consumption of Aquatic Organisms.* The detection limits for DDE and DDT in ponded water in Cleveland Harbor CDF 10B are greater than the water quality criteria for human health (Table 10). When equilibrium partitioning is used to estimate water concentrations of these pesticides from their maximum sediment concentrations, the calculated water concentration for DDE is lower than its water quality criterion (Table 10a). The estimated water concentration of DDT slightly exceeds its water quality criterion. However, all the reported results for DDT in sediment were below laboratory analytical detection limits. The actual concentration of DDT in sediments is likely to be lower than these detection limits. Because the estimated water concentration of DDT only slightly exceeds its water quality criteria, and because this is only a marginally complete exposure pathway, no further evaluation of this pathway is warranted.

f. *Conclusions for pesticides.* The pesticide DDT and its degradation product, DDE, were detected in CDF 10B soils. The levels detected are not enough to pose a risk to humans via direct contactor consumption of aquatic organisms, or to aquatic organisms themselves. However, there is not enough information to eliminate the potentially complete pathway of animal bioaccumulation from further consideration. This pathway should be evaluated further for pesticides.

5.4.5 PCBs

a. *Comparison to Reference or Background* – Sediment concentrations of PCBs at the nearest available lake reference location (Rocky River Harbor lake reference area just west of Cleveland) were all below the lower detection limit, with detection limits ranging from 18.5 to 21 ppb. The PCB concentrations detected in Cleveland Harbor CDF 10B are above these lake reference levels, so it is concluded that PCBs are present in elevated levels in this CDF.

b. *Direct Human Contact* – Four different PCB mixtures (Aroclor 1242, Aroclor 1248, Aroclor 1254, and Aroclor 1260) were detected in CDF 10B soils and sediments. The only exceedance of the PRGs was for Aroclor 1242, which exceeded the residential PRG, in sediments only (Table 6). The soil concentration of Aroclor 1242 was less than the residential PRG. The industrial PRG was not exceeded for any of the PCBs detected. Therefore, no further evaluation of this pathway is warranted.

c. *Uptake by Biota* – To evaluate the potential for PCBs to bioaccumulate, the concentrations of PCBs were compared to criteria established in the biosolids USEPA Rule 503. As seen in Table 7, the maximum and average PCBs results from soils collected from the CDF were below the associated biosolid limit. The critical exposure pathway for the PCB biosolid limit was an adult eating animal product, in which the animals were eating the biosolid. As this pathway considered bioaccumulation, the potential for human health risks from animal uptake of PCBs is low. Although the biosolids rule limit does not consider if the bioaccumulation of PCBs is potentially harmful to the animals themselves, the measured concentrations of PCBs at the site are all below 1 ppm, which is considered a threshold for protection of terrestrial ecosystems (USEPA 2001).

d. *Aquatic Organism Exposure* – In the Cleveland Harbor CDF 10B sediments, the maximum concentration of total PCBs detected exceeded the sediment consensus TEC, but not the sediment consensus PEC (Table 8). The average concentration of total PCBs detected was below the sediment consensus TEC.

Although no PCBs were detected in ponded water in Cleveland Harbor CDF 10B, the detection limits for PCBs were above the CCC for protection of aquatic organisms (Table 9). Therefore, equilibrium partitioning was used to estimate the water concentration from the maximum detected PCB concentration (Table 9a). The calculated water concentration is still greater than the CCC, so further evaluation of this pathway is warranted.

e. *Human Consumption of Aquatic Organisms.* The detection limits for PCBs in water are greater than the water quality criterion for human health (Table 10). When equilibrium partitioning is used to estimate water concentrations of total PCBs detected from their maximum sediment concentration, the calculated water concentration is still above the water quality criterion for PCBs, for protection of human health (Table 10a). Therefore, further evaluation of this pathway may be warranted if these pathways continue to be complete under future site use.

f. *Conclusions for PCBs* – The levels of PCBs detected in Cleveland Harbor CDF 10B media would not pose a risk via direct human contact. In addition, the levels of PCBs are well below 1 ppm, and so would not be a concern to ecological receptors in a terrestrial setting. However, there is not enough information to eliminate PCB exposure to aquatic organisms, or human consumption of aquatic organisms as pathways of concern. Further evaluation of these pathways may be warranted.

5.4.6 BNAs:

The only BNAs detected in Cleveland Harbor CDF 10B media, aside from the PAHs mentioned above, was bis(2-ethylhexyl) phthalate (BEHP). This BNA is a common laboratory contaminant, and the concentrations detected in the media from the CDF are typical concentrations that can be attributable to laboratory contamination. Therefore, no further evaluation of BNAs is necessary.

5.4.7 Cyanide:

There are very few evaluation criteria to compare the cyanide results to. There are no background levels, biosolids criteria, or consensus PEC or TEC values relative to cyanide. However, residential and industrial PRG criteria do exist for cyanide. The cyanide concentrations reported for the soils and sediments from the Cleveland Harbor CDF 10B were well below the USEPA PRG criteria (both residential and industrial) (Table 6). As such, it is unlikely that the cyanide concentrations in the CDF soils and sediments pose a risk to human health or the environment.

5.4.8 Dioxin:

One soil sample was selected for dioxin analysis from the three sediment samples collected in May 2004. The one sediment sample was chosen for dioxin analysis because it had the highest concentrations of PAHs and an elevated TOC concentration relative to the other two samples; thus increasing the potential for a bias in dioxin results.

The USEPA has decided that it is not necessary to regulate dioxin in land-applied sewage sludge (USEPA 2003). As part of their decision, the USEPA performed a Screening

Ecological Risk Analysis (SERA) on the risks to wildlife due to exposure to dioxins from land-applied sewage sludge. While the estimates are not without some uncertainty, the SERA indicates that wildlife should not be significantly impacted as a result of exposure to dioxins in land-applied sewage sludge.

No sediment effects concentrations have been established for dioxin (USEPA 2002b). As for PAHs and VOCs, no National Recommended Water Quality Criteria for the protection of freshwater aquatic organisms have been developed for dioxin[1] (USEPA 2002b).

The measured concentration of dioxin from the selected soil sample from Cleveland Harbor CDF 10B was below the residential and industrial USEPA PRG values (Table 6). Therefore dioxin is not a direct contact hazard for humans at the site. Additionally, due to its low aqueous solubility, dioxin is not expected to be present at detectable concentrations in the ponded water in Cleveland Harbor CDF 10B.

Based on the evaluation above, dioxin does not appear to be an environmental concern at Cleveland Harbor CDF 10B, and therefore, no further evaluation of dioxin is warranted.

5.4.9 Explosives:

No explosives were detected in any samples taken at Cleveland Harbor CDF 10B. In addition, based on surrounding land use as well as sampling of pre-dredged sediments, these constituents are not expected to be present in appreciable levels in the CDF. Therefore, explosives are eliminated from further evaluation.

5.5 Tier I Conclusions and Recommendations

The following conclusions about contaminant releases and contaminant-related environmental effects from Cleveland Harbor CDF 10B can be made. These Tier I conclusions are based upon a review of information that currently exists on the CDF, focusing on the 2004 results of sampling and analysis of CDF soils, sediments, and water. It is assumed that sediments that are currently being placed into the facility, as well as sediments to be dredged from these same areas in the future, are and will continue to be, less contaminated than the sediments placed in the CDF in the past.

1) *Conclusions for VOCs*: Although five VOCs were detected in Cleveland Harbor CDF 10B soils and sediments, they are not present in concentrations that would pose a risk to human health or ecological receptors, for any of the complete exposure pathways identified for this CDF. No further evaluation of VOCs is necessary.

2) *Conclusions for Metals.* Several metals may be elevated relative to background or reference sediment values (i.e., cadmium, copper, and zinc). Although these metals are not elevated enough to act as potential constituents of concern for some of the relevant exposure pathways (direct human contact, aquatic organism exposure, or human consumption of aquatic organisms), there is not enough information to eliminate the biota uptake pathways from further consideration. Additional

evaluation of metal bioaccumulation (for cadmium, copper, and zinc), especially via plant uptake, is warranted.

3) *Conclusions for PAHs.* Several PAHs are elevated above lake reference concentrations. Although these PAHs are not elevated enough to act as potential constituents of concern for any of the potentially complete exposure pathways at this CDF. No further evaluation of PAHs is warranted.

4) *Conclusions for pesticides.* The pesticide DDT and its degradation product, DDE, were detected in Cleveland Harbor CDF 10B soils. The levels detected are not enough to pose a risk to humans via direct contact or consumption of aquatic organisms, or to aquatic organisms themselves. However, there is not enough information to eliminate the potentially complete pathway of animal bioaccumulation from further consideration. This pathway should be evaluated further for pesticides.

5) *Conclusions for PCBs* – The levels of PCBs detected in Cleveland Harbor CDF 10B media would not pose a risk via direct human contact. In addition, the levels of PCBs are well below 1 ppm, and so would not be a concern to ecological receptors in a terrestrial setting. However, there is not enough information to eliminate PCB exposure to aquatic organisms, or human consumption of aquatic organisms as pathways of concern. Further evaluation of these pathways would be warranted only if surface water ponds on the site that would serve as habitat for fish. As the CDF become filled, surface water ponding would be eliminated, so this pathway would remain incomplete and would not be a concern. Furthermore, future use of the CDF for airport expansion would preclude the presence of surface water and fish on site.

6) *Conclusion for BNAs, Cyanide, Dioxin, and Explosives.* Based on the analyses conducted, these constituents are not expected to be an environmental concern for Dike 10B CDF. Therefore, these constituents are eliminated from further evaluation.

7) Leaching of Cleveland Harbor CDF 10B constituents is not a concern due to the placement of the facility in open water, as well as absence of a groundwater aquifer for drinking water purposes at this site. No further evaluation of the leaching pathway is warranted.

5) Because of the remaining capacity of the CDF, discharge of effluent into Lake Erie is not currently a concern. This pathway should be re-evaluated when the CDF nears capacity in the future.

This Tier I evaluation concluded that there is enough information to dismiss from further concern, some of the contaminants in the CDF. However, there is not enough information at this stage to eliminate the following potentially complete pathways and contaminants: (1) Plant bioaccumulation of cadmium, copper, and zinc, (2) Animal bioaccumulation of DDT and DDE, (3) Aquatic organism exposure to PCBs, and (4) Human consumption of aquatic organisms which have bioaccumulated PCBs. Before any decision regarding need for management actions in this CDF are made, these potentially complete exposure pathways and contaminants should be evaluated in subsequent Tier evaluations, as recommended in the UTM. For evaluation of metals via plant bioaccumulation, the UTM recommends that the potential for plant uptake be estimated by the extraction of metals from the dredged material using diethylenetriaminepentaacetic acid (DTPA), in conjunction with a computerized plant uptake program (Tier II). If further evaluation is still needed after this, then plant bioaccumulation studies may be conducted (Tier III). For animal bioaccumulation of pesticides, the UTM recommends performing earthworm uptake studies (Tier III). For evaluation of whether or not PCBs could pose a risk to aquatic organisms, the UTM recommends repeating the water quality screen with a consideration of mixing effects (Tier II), and then if needed, complete water quality toxicity tests (Tier III). Finally, in order to evaluate whether or not the pesticides DDT and DDE, as well as PCBs could pose a risk to human health via consumption of aquatic organisms, the UTM recommends repeating the water quality screen with a consideration of mixing effects (Tier II), and then if needed, analyse fish tissues for the constituents of potential concern (Tier III).

The ponding of surface water on the CDF is assumed to be a transient condition. Once the CDF has been filled to capacity with dredged material, the final grading should preclude the presence of ponded surface water on the CDF. Therefore, the surface water pathways will not be complete in the future, especially under final land use of airport expansion, and so will not be evaluated further. Only the terrestrial exposure pathways (i.e., animal bioaccumulation) warrant further evaluation.

6.0 TIER II EVALUATION

6.1 Tier II Prediction of Plant Bioaccumulation Potential

The Tier I evaluation determined plant and animal uptake were contaminant pathways of concern and further testing was necessary to evaluate the potential for uptake by plants and animals exposed to dredged material in the Cleveland Harbor CDF 10B. The UTM (USACE, 2003) suggests proceeding to Tier II testing if a decision cannot be reached in Tier I. The procedures for predicting plant bioaccumulation potential under Tier II includes (1) chemical analysis of plant tissues growing in the CDF and comparison to like tissues growing in a reference or background area and/or (2) the chemical extraction of dredged material using a chelating agent diethylenetriaminepentaacetic acid (DTPA) and comparison to chemical extraction of a reference soil.

The comparison of contaminant concentrations in plant materials collected from a CDF and reference site requires that the same plant species must exist on both sites. This can sometimes be a difficult proposition and comparison between dissimilar species may not be valid as uptake potential varies by species. The DTPA procedure has been used in a number of studies to successfully predict plant bioaccumulation from dredged material placed in terrestrial (wetland and upland) environments (Lee, Folsom, and Engler 1982; Lee, Folsom, and Bates 1983; U.S. Army Engineer Waterways Experiment Station, 1987) and compared well with actual concentrations of metals in leaves of bioassay plants. However, actual plant exposures tend to be a more reliable method of evaluating plant response to contaminant exposures *in situ*.

For the reasons described above it was recommended by the developers of the UTM at the US Army Engineer Research and Development Center, Vicksburg, MS (ERDC-Vicksburg) to skip the Tier II testing and proceed directly to the more quantitative Tier III bioassay test procedure.

6.2 Tier II Theoretical Bioaccumulation Potential

The Tier II animal screen suggests the use of theoretical bioaccumulation potential (TBP) for predicting bioaccumulation of nonpolar organics. This includes the chlorinated hydrocarbon pesticides, many other halogenated hydrocarbons, PCBs, many PAHs including all the priority pollutant PAHs, dioxins, and furans. However, the TBP been used mainly for calculating bioaccumulation of nonpolar organics in aquatic animals and its utility for predicting bioaccumulation in soil invertebrates has not been confirmed to date. Again, UTM developers at the ERDC-Vicksburg suggested proceeding directly to the Tier III bioassay procedure.

6.3 Soil Screening Levels for Beneficial Use

Beneficial use of dredged material includes the use of the CDF and material within once the CDF is filled and no longer used for dredged material placement. The Great Lakes Commission developed a regional testing manual (Beneficial Use Upland Testing and Evaluation Project Management Team, 2004a and b) for the upland beneficial use of dredged material in the Great Lakes Area. State guidance and regulatory criteria for contaminant limitations appropriate for this project are provided in the manual http://www.glc.org/upland/download/UplandFramework_2.pdf and is summarized in Table 1 for the contaminants of interest. While criteria are not available for all contaminants of interest, many are and may be used to determine suitability of dredged material for specific purposes. For the State of Ohio, soil criteria for residential cover and unrestricted fill are adapted from Canadian Soil Quality Guidelines (Canadian Council of Ministers of the Environment, 2006 http://www.ccme.ca/assets/pdf/ceqg_soil_summary_table_v6_e.pdf). Ohio criteria for industrial use is based on Ohio sewage sludge rules (Ohio Administrative Code 3745-40) http://www.epa.state.oh.us/dsw/rules/3745-40.html. The monthly average concentrations are shown in Figure 1. The Canadian Soil Quality Guidelines are provided in Figure 2.

7.0 TIER III EVALUATION

7.1 Tier III Plant and Animal Bioaccumulation Tests

The purpose of Tier III plant and animal bioaccumulation test is to determine the potential migration of contaminants from the CDF through the food-chain. The bioavailability of contaminants to plants and animals exposed to dredged material in the CDF is a means of determining the potential risks to these receptors outside the CDF. For most contaminants, there is not a linear relationship between the concentration in dredged material and bioavailability to plants and soil invertebrates; thus, actual biological exposures to the dredged material in question must be conducted. The UTM recommends conducting bioassays on the dredged material in question as well as on a reference sediment or soil. Actual bioaccumulation in tissues exposed to dredged material and reference soil contaminants determines the potential risks posed to food webs in comparison to local conditions.

The Tier III procedure for plants determines the potential bioaccumulation of contaminants of any contaminant under freshwater terrestrial conditions by *Cyperus esculentus*, a representative plant species found in both wetland and upland soil conditions. The plant bioassay provides information on (1) ability of the dredged material to support plant survival and growth, (2) bioavailability and mobility of contaminants from soil to the above-ground plant tissues and (3) the potential for contaminant movement to higher organisms (e.g., birds, mammals, amphibians, reptiles) from off the site linked to plants in the food web.

The Tier III procedure for animals determines the potential bioaccumulation of any contaminant under freshwater terrestrial conditions by earthworms, a representative soil invertebrate known to accumulate a wide variety of contaminants from the soil in which it lives. This standardized test procedure has been published as ASTM Standard Procedure SE-1676 (ASTM 1997). The bioaccumulation assay provides information on (1) bioavailability and mobility of contaminants from soil to soil-dwelling earthworms, and (2) the potential for contaminant movement to higher organisms (e.g., birds, mammals, amphibians, reptiles) from off the site that are linked to earthworms in the food web.

7.2 Regulatory Guidance

Chapter 1 of the UTM (USACE, 2003) discusses the regulatory authorities governing placement of dredged material in CDFs. The direct uptake or bioaccumulation of contaminants by wetland and terrestrial plants and animals is not directly governed by any specific regulations. The plant and animal uptake pathways for CDFs receiving dredged material are unique in that dredged material is not sewage sludge, solid waste, or an industrial byproduct and therefore the regulatory authorities over those materials cannot be applied to dredged material in a CDF. Once dredged material is placed in a CDF it is essentially a soil and since it is generally from the adjacent waterway it may contain low levels of contaminants from various anthropogenic sources. Statutory or regulatory regimes used for land application of sludge or industrial waste products were developed based on the risks posed by the use of those materials and are not applicable for CDF placement of dredged material. The general mandate under NEPA requires evaluations of the uptake pathways, since uptake and subsequent movement of contaminants into food webs may result in impacts outside the CDF. In the UTM, the potential uptake of contaminants into plant and animal tissue is compared to that for a reference material representative of soils in the vicinity of the CDF. Generally, if the dredged material uptake exceeds that for the reference, the potential environmental impact of the plant or animal uptake pathway outside of the CDF is evaluated in the context of a risk assessment.

For beneficial uses of dredged material there is little guidance for determining suitability of dredged material for any given use based on its contaminant concentrations. The soil screening levels described in section 6.3 above can be used to determine suitability of dredged material for beneficial purposes. Some states use various soil quality criteria derived form a number of sources including USEPA 503 Rule sewage sludge limitations, ecological/human health soil screening levels, remediation or cleanup goals for superfund sites, etc. The use of these varies in regulatory application by states and some are applied with a pass (suitable) or fail (not suitable) philosophy. In the testing protocols under the UTM, a Tier II screening level should determine whether suitability can be determined at the Tier II level or whether further testing under Tier III is required to make that decision. In that context, soil criteria based on protection of ecological or human health should be sufficient to determine if a dredged material is suitable for specific beneficial uses and to determine if additional testing is required.

7.3 Methods and Materials

7.3.1 Sample Collection and Preparation

Samples of dredged material and reference soils were collected by USACE-LRB personnel during the month of April, 2006. A 13-liter polyethylene bucket was filled from three locations within Cleveland Harbor CDF 10B and the Cleveland Lakefront State Park for a total of three buckets from each site. The buckets were sealed and shipped to the ERDC-Vicksburg. Upon sample receipt the three buckets from each site were mixed to form one composite sample each for Cleveland Harbor CDF 10B and the Cleveland Lakefront State Park.

7.3.2 Plant and Earthworm Bioassays

The plant and earthworm bioassays were conducted on both reference soils and dredged materials following the methods in the UTM (USACE, 2003). The plant bioassay followed Section H.3 Tier III – Laboratory Plant Bioaccumulation Procedures in Appendix H of the UTM. After completion of the plant bioassay, the soil materials were remixed within each bioassay unit and the earthworm bioassay was conducted on that same material following procedures in Section G.3 Tier III - Terrestrial Animal Bioaccumulation Test, found in Appendix G of the UTM. Both tests were conducted in the ERDC-Vicksburg facilities.

7.3.3 Evaluation Parameters

Samples of each composite were analyzed for metals, PCBs (as Arochlors), and total organic carbon (TOC). Results of chemical analysis were compared to soil criteria described in Section 6.3. At the end of the bioassay period, plant biomass was determined on the above-ground portion of the plant. Above-ground plant tissues were dried, ground and analyzed for arsenic, silver, cadmium, chromium, copper, mercury, nickel, lead and zinc. Earthworms were collected at the end of the bioassay period, counted and weighed to determine effects on survival and growth. Earthworm tissues were ground and analyzed for PCBs. Tissue concentrations of contaminants in both plants and earthworms exposed to CDF dredged material was compared to reference soil tissues. For determination of means, values below the method detection limit (MDL) were set at the MDL numerical value.

7.4 Results and Discussion

7.4.1 Physical and Chemical Soil Characteristics

Characteristics of the Cleveland Harbor CDF 10B and Reference site are shown in Table 2. The Reference soil consisted of considerably more sand than the CDF dredged material and had a lower pH response. Total organic carbon (TOC) was also higher in the Cleveland Harbor CDF 10B dredged material. Results of chemical analysis of the Cleveland Harbor CDF 10B and Cleveland Reference soils are shown in Table 3. Concentrations of all metals, except Ag, were shown to be higher in the CDF dredged material than in the Reference soil. Ag was not detected in either material. Results of analysis for PCBs (as Arochlors) and DDT and breakdown products DDE and DDD indicate detectable levels of Arochlor 1248 in dredged material only. DDT was not detected in either the CDF dredged material or Reference material while the breakdown product DDE was detected in both and DDD was only detected in the CDF dredged material. Detectable contaminants in the CDF dredged material were generally higher than contaminants in the Reference material. However, the increased concentration alone does not result in increased bioaccumulation by organisms. Other soil properties influence the availability of contaminants through various contaminant pathways which is why bioassays are valuable in determining actual uptake of contaminants due to exposure.

Contaminant concentrations of the CDF dredged material was compared to soil criteria in section 6.3. All contaminants, except arsenic, in Cleveland Harbor CDF 10B dredged material were below the Ohio criteria for unrestricted fill or the Canadian Soil Quality Guidelines for residential/parkland use (Figure 1 and 3). Arsenic concentration in Cleveland Harbor CDF 10B dredged material was 13 mg kg^{-1} while the criteria for residential or unrestricted fill is 12 mg kg^{-1}. With replicate analysis and statistical comparison, the dredged material arsenic my not statistically exceed the criterion. Assuming all stakeholders and regulatory authorities would agree with the screening level comparison to determine suitability, the Cleveland Harbor CDF 10B dredged material would be considered suitable for residential, parkland or unrestricted fill. However, agreement to this approach is not widely held by many states and additional testing is generally required for such determination.

7.4.2 Plant Growth and Uptake of Metals

Total above-ground plant biomass after 45 days of growth is shown in Table 16. The dredged material from Cleveland Harbor CDF 10B (Figure 8) was found to produce more robust plant growth compared to the Reference soil (Figure 9). The fresh weight biomass of 118.2 grams was nearly twice the biomass produced in the Reference soil. The results from chemical analysis, shown in Table 17, demonstrate that while the concentrations of metals were higher in the CDF dredged material, plant tissue concentrations were not. None of the metals analyzed in tissue of *Cyperus esculentus* grown in Cleveland Harbor CDF 10B dredged material exceeded concentrations in tissues grown in the Reference site soil. While the reference site soil had lower concentrations of metals, bioavailability of these metals to plants was actually higher. This is probably due to the lower pH of 5.7 and possibly to the lower TOC while other properties, such as variations in essential nutrients, may also contribute.

While there are no specific regulatory limitations on ecological plant tissue contaminants there are some guidelines that can be made useful. The European Commission (EU) has set action levels contaminants in foodstuffs (http://eur-lex.europa.eu/LexUriServ/site/en/consleg/2001/R/02001R0466-20051129-en.pdf) which can be compared to plant tissue levels. Action levels for lead and cadmium in leafy vegetables (wet weight), is 0.3 and 0.2 mg kg^{-1}, respectively. Converting for the wet weight concentration, the CDF plant tissue lead and cadmium would be 0.77 and 0.27 mg kg^{-1}, respectively. While CDF plant tissues may exceed the EU action levels for leafy vegetables, plant tissue lead and cadmium in the Reference material is higher and due to the industrial history of the Cleveland area, other vegetated soils in the area would be expected to produce similar results.

7.4.3 Earthworm Growth and Uptake of Organic Contaminants

Initial (Day 0) and 28-day earthworm weights and counts are shown in Table 18. Mean lipid content of earthworms at the start of the test procedure was 19.3 mg kg^{-1}. Overall, recovered worms and recovered weight was less in the CDF dredged material compared to the Reference and control. Loss of earthworms in all test materials can be explained by death and decomposition but cause of death is uncertain. Stress or injury during handling and transfer to test media or competition for food are possible explanations. The 28-day exposure of earthworms to test materials did result in uptake of PCBs and DDT pesticides as shown in Table 19. Arochlor 1248 was the only PCB compound detected in earthworm tissues from both the CDF dredged material and the Reference material. Pesticides DDT, DDE and DDD were all detectable in earthworms exposed to CDF dredged material while only DDE was detected in Reference material earthworms. Concentrations of PCB and DDT pesticides were higher in dredged material earthworms compared to Reference material earthworms but are not considered elevated. Eisler (1986) suggests a level of <0.64 mg PCBs/kg fresh weight of diet for mink (very sensitive to PCBs) and <3.0 mg PCBs/kg fresh weight of diet for birds (more resistant to PCBs). Concentrations of PCBs in earthworms exposed to CDF dredged material were 0.041 mg kg-1, below the dietary concentration suggested by Eisler (1986) as protective for more sensitive species.

DDT uptake by earthworms is of concern due to the high level of tolerance to the compound by earthworms. Earthworms have been shown to be unaffected by DDT at levels of 2000 mg kg^{-1} soil (Goffart, 1949). However, bioaccumulation of DDT by earthworms can result in adverse effects to other species in the food chain. WHO (1989) summarizes the environmental aspects of DDT and its derivatives. Effects on birds are mostly associated with thinning of eggshells and WHO found the lowest reported dietary concentration of DDT reported to cause shell thinning experimentally was 0.6 mg kg^{-1} for the black duck. Earthworms exposed to CDF dredged material contained concentrations of DDT and its derivatives 2 orders of magnitude below this.

7.5 TIER III Conclusion

Contaminants in the Cleveland Harbor CDF 10B dredged material are below numerical criteria deemed suitable for beneficial uses. However, at this time the suitability for beneficial uses may not be determined acceptable by such comparisons alone. Tier III plant and earthworm bioassays were conducted on Cleveland Harbor CDF 10B dredged material and compared to the Cleveland Lakefront State Park (Reference). Plant uptake of metals by *Cyperus esculentus* grown in dredged material from the Cleveland Harbor CDF 10B did not exceed uptake from the Reference material. Since the availability of metals to plant uptake in the Cleveland Harbor CDF 10B was lower than from the Reference soil, there is no increased risk associated with the plant uptake of contaminants from the Cleveland Harbor CDF 10B. Other plant species, such as trees, may increase the uptake of some metals while some species, such as fine fescues, can minimize uptake of metals (Palazzo 2003). A lowering of pH over time may also increase metal uptake by plants. Management options to ensure conditions attributable to higher plant uptake of metals may include establishment of grasses, such as fine fescues, and monitoring of pH and subsequent liming to maintain pH levels above 6.5.

Earthworms exposed to Cleveland Harbor CDF 10B dredged material and Reference material were analyzed for PCBs and DDT pesticides. While uptake of PCB (as Arochlor 1248) in the dredged material exceeded that of the Reference material, the concentrations were determined to be well below minimum dietary concentration posing adverse risks to higher animals. DDT, DDE and DDD were also higher earthworms exposed to dredged material compared to the Reference but these concentrations were 2 orders of magnitude less than minimum dietary concentrations causing adverse effects to higher animals.

8.0 Recommendations for CDF Beneficial Use and Management

The intended post-closure beneficial use of the CDF is for airport expansion. Federal Aviation Administration regulations will likely require a vegetative cover that reduces hazards for airport operations. This will likely require that vegetative cover be a turf-type that has little attraction for wildlife, particularly birds. Based on the results of this study, this beneficial use activity will not result in increased migration of contaminants outside the CDF. Uptake of cadmium by plants will be minimized by maintaining soil pH and limiting growth of woody species. Management in post-closure use should include the establishment of turf grass and management of soil pH between 7.5 and 6.5. Fine fescues are recommended but other turf species may be used as well.

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FIGURES

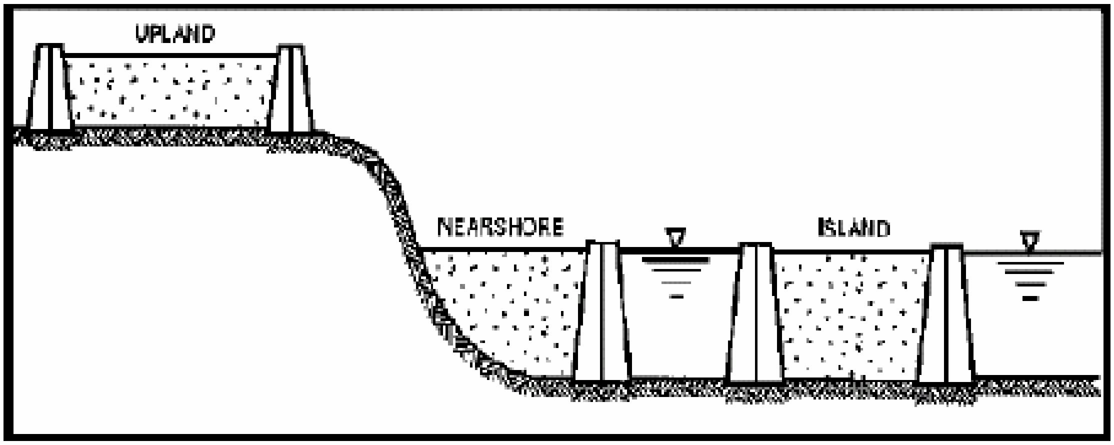


Figure 1: **Schematic of upland, nearshore and island CDFs (after USACE/EPA 1992)**

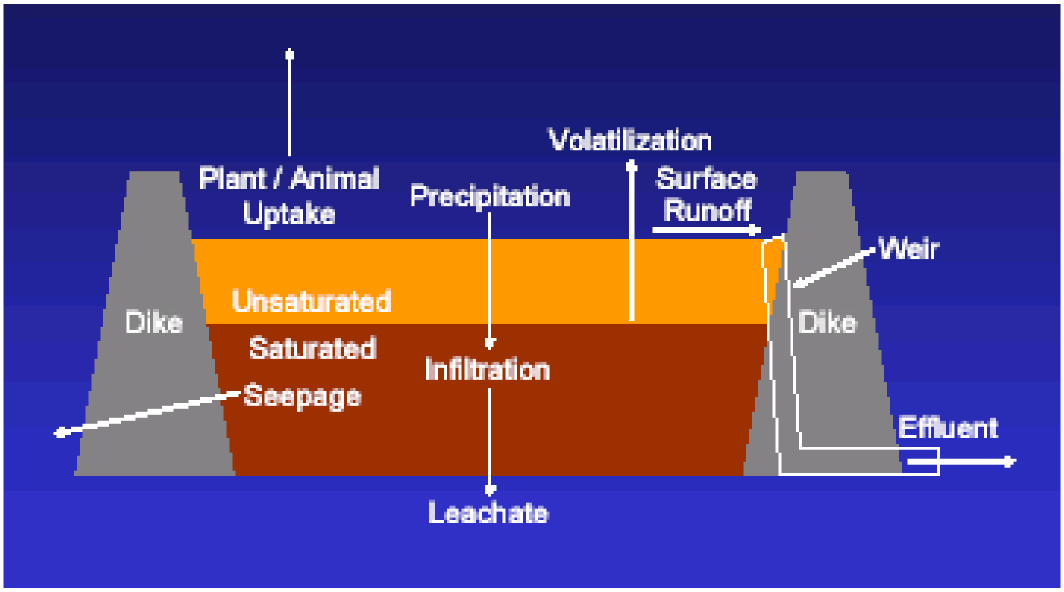


Figure 2: Schematic of contaminant migration pathways for upland CDFs (USACE 2003).

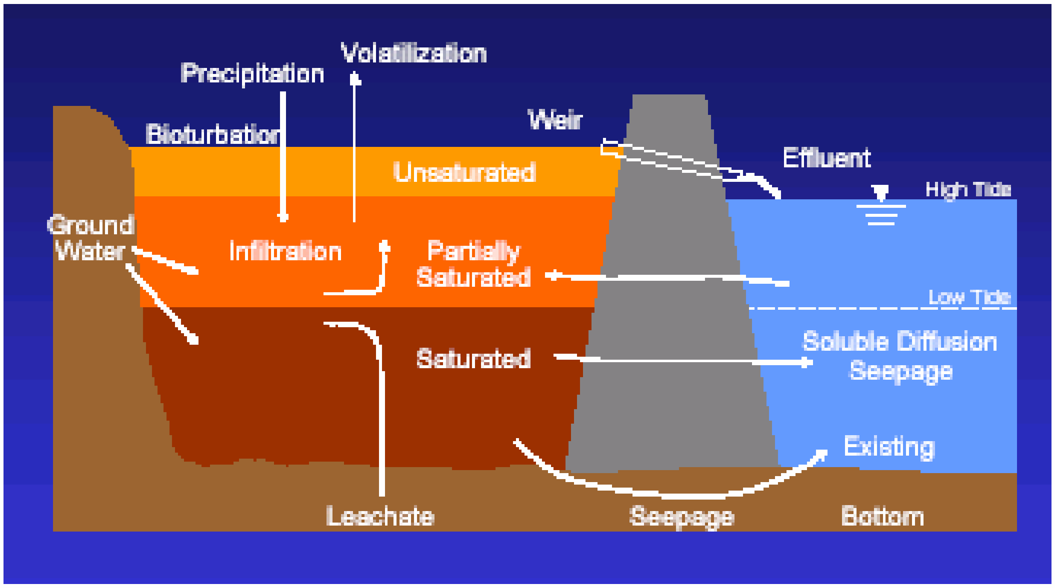


Figure 3: **Schematic of contaminant migration pathways for nearshore CDFs (USACE 2003).**

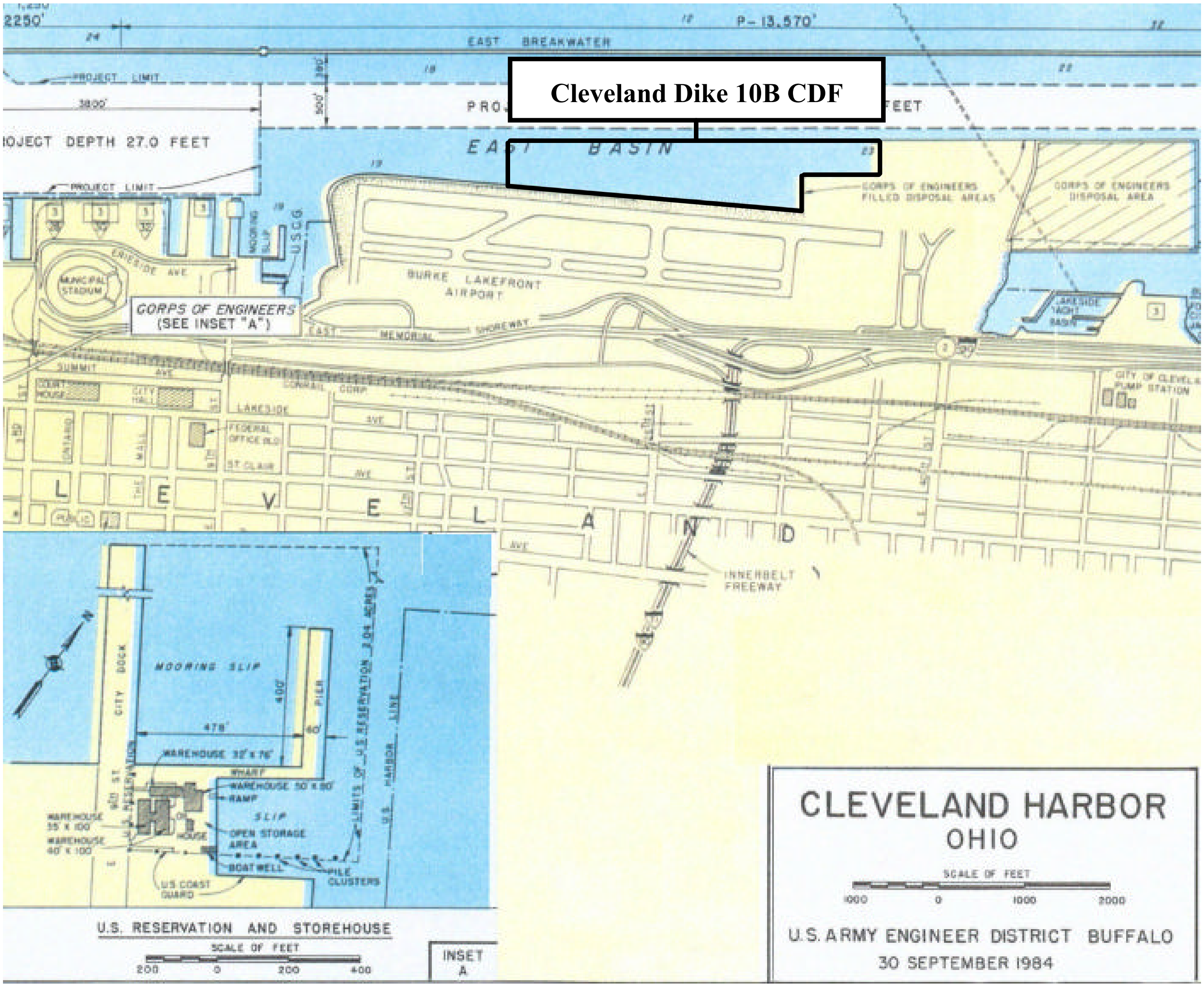
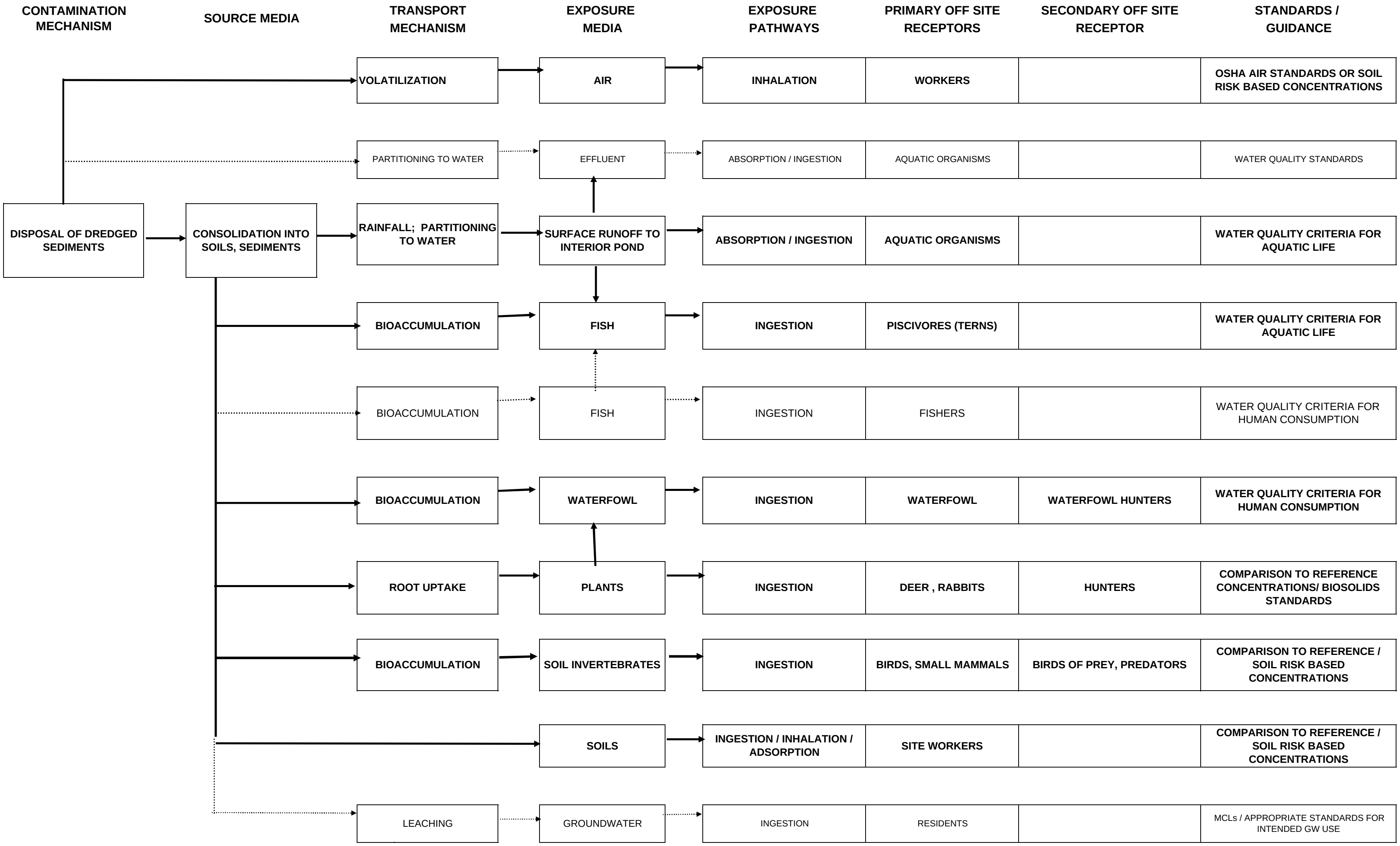


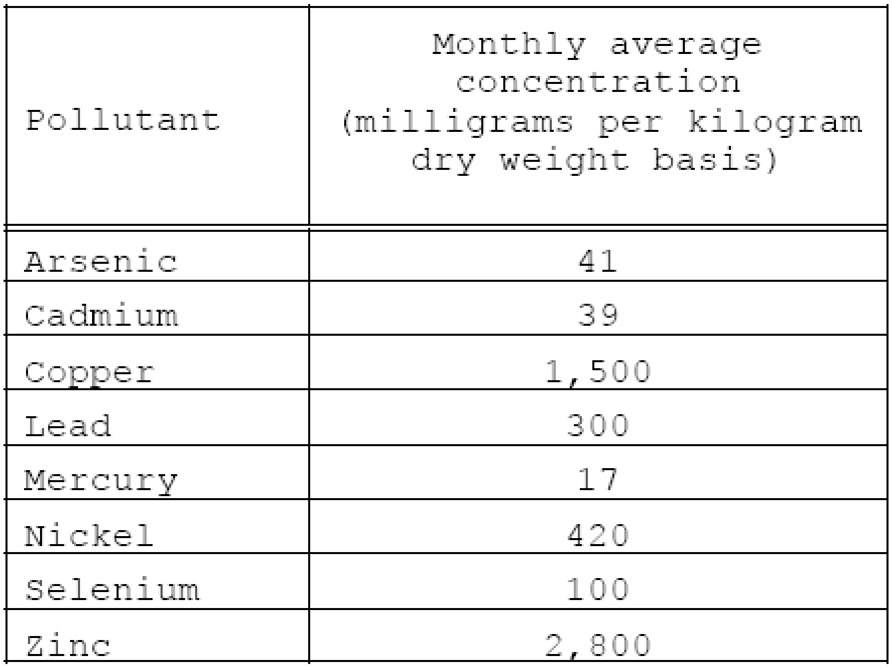
Figure 4: Cleveland Harbor Dike 10B CDF Site Map

Figure 5. TIER 1 GRAPHIC CONCEPTUAL SITE MODEL ~ PATHWAYS FOR INITIAL EVALUATION OF CLEVELAND HARBOR CONFINED DISPOSAL FACILITY 10B



CONTAMINATION MECHANISM	SOURCE MEDIA	TRANSPORT MECHANISM	EXPOSURE MEDIA	EXPOSURE PATHWAYS	PRIMARY OFF SITE RECEPTORS	SECONDARY OFF SITE RECEPTOR	STANDARDS / GUIDANCE
		VOLATILIZATION	**AIR**	**INHALATION**	**WORKERS**		**OSHA AIR STANDARDS OR SOIL RISK BASED CONCENTRATIONS**
		PARTITIONING TO WATER	EFFLUENT	ABSORPTION / INGESTION	AQUATIC ORGANISMS		WATER QUALITY STANDARDS
DISPOSAL OF DREDGED SEDIMENTS	**CONSOLIDATION INTO SOILS, SEDIMENTS**	**RAINFALL; PARTITIONING TO WATER**	**SURFACE RUNOFF TO INTERIOR POND**	**ABSORPTION / INGESTION**	**AQUATIC ORGANISMS**		**WATER QUALITY CRITERIA FOR AQUATIC LIFE**
		BIOACCUMULATION	**FISH**	**INGESTION**	**PISCIVORES (TERNS)**		**WATER QUALITY CRITERIA FOR AQUATIC LIFE**
		BIOACCUMULATION	FISH	INGESTION	FISHERS		WATER QUALITY CRITERIA FOR HUMAN CONSUMPTION
		BIOACCUMULATION	**WATERFOWL**	**INGESTION**	**WATERFOWL**	**WATERFOWL HUNTERS**	**WATER QUALITY CRITERIA FOR HUMAN CONSUMPTION**
		ROOT UPTAKE	**PLANTS**	**INGESTION**	**DEER , RABBITS**	**HUNTERS**	**COMPARISON TO REFERENCE CONCENTRATIONS/ BIOSOLIDS STANDARDS**
		BIOACCUMULATION	**SOIL INVERTEBRATES**	**INGESTION**	**BIRDS, SMALL MAMMALS**	**BIRDS OF PREY, PREDATORS**	**COMPARISON TO REFERENCE / SOIL RISK BASED CONCENTRATIONS**
			SOILS	**INGESTION / INHALATION / ADSORPTION**	**SITE WORKERS**		**COMPARISON TO REFERENCE / SOIL RISK BASED CONCENTRATIONS**
		LEACHING	GROUNDWATER	INGESTION	RESIDENTS		MCLs / APPROPRIATE STANDARDS FOR INTENDED GW USE

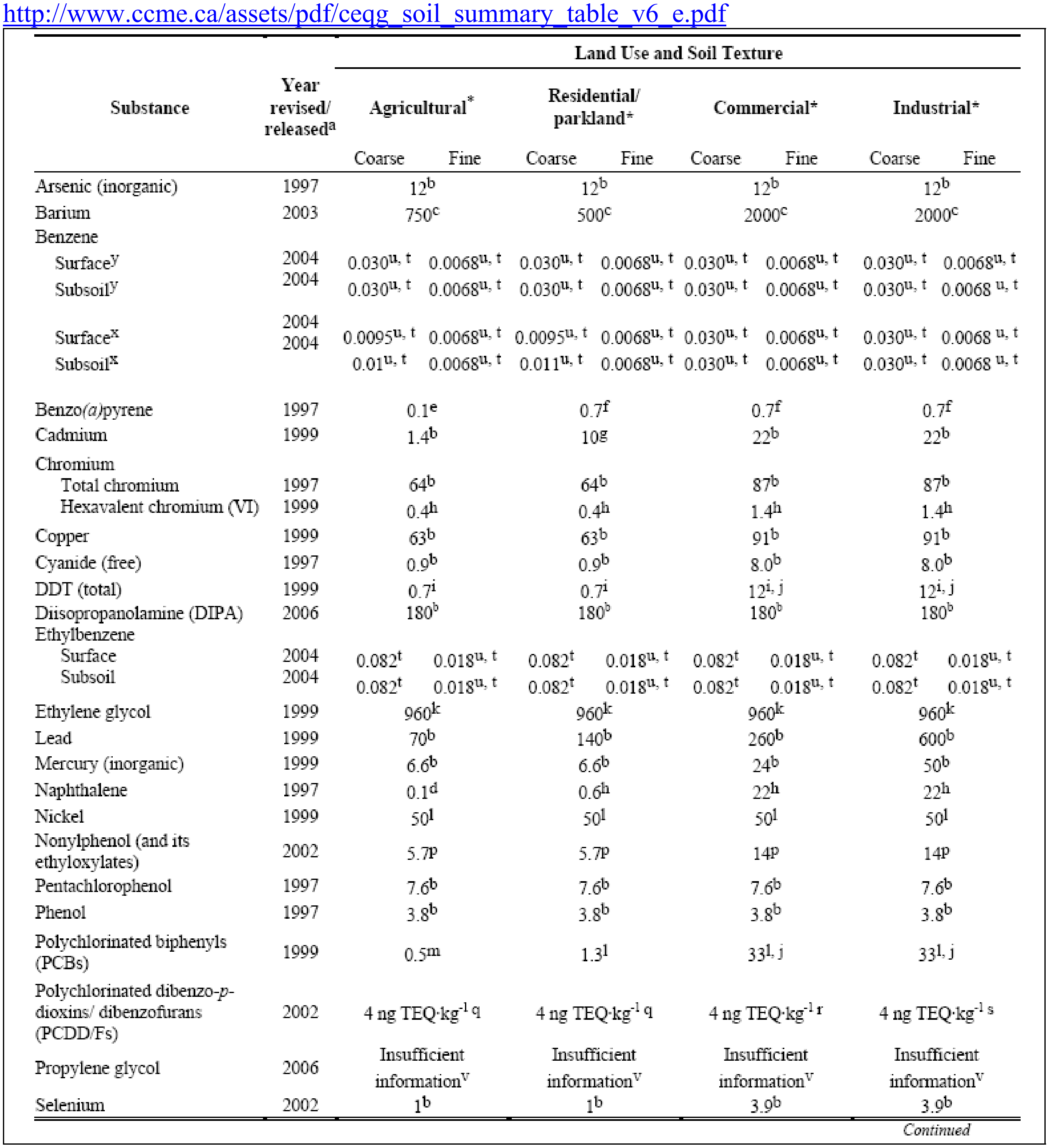
Notes:
Bold indicates the pathway is complete and should be evaluated for this CDF
Regular font and dashed arrows indicates that this pathway is incomplete and does not have to be evaluated for this CDF.



Pollutant	Monthly average concentration (milligrams per kilogram dry weight basis)
Arsenic	41
Cadmium	39
Copper	1,500
Lead	300
Mercury	17
Nickel	420
Selenium	100
Zinc	2,800

Figure 6. State of Ohio land application restrictions for sewage sludge (monthly average) http://www.epa.state.oh.us/dsw/rules/40-05.pdf.

Figure 7. Canadian Soil Quality Guidelines (CSQG) from:
http://www.ccme.ca/assets/pdf/ceqg_soil_summary_table_v6_e.pdf



Substance	Year revised/ released^{a}	Land Use and Soil Texture							
		Agricultural*		Residential/ parkland*		Commercial*		Industrial*	
		Coarse	Fine	Coarse	Fine	Coarse	Fine	Coarse	Fine
Arsenic (inorganic)	1997	12^{b}		12^{b}		12^{b}		12^{b}	
Barium	2003	750^{c}		500^{c}		2000^{c}		2000^{c}	
Benzene									
Surface^{y}	2004	0.030$^{u, t}$	0.0068$^{u, t}$	0.030$^{u, t}$	0.0068$^{u, t}$	0.030$^{u, t}$	0.0068$^{u, t}$	0.030$^{u, t}$	0.0068$^{u, t}$
Subsoil^{y}	2004	0.030$^{u, t}$	0.0068$^{u, t}$	0.030$^{u, t}$	0.0068$^{u, t}$	0.030$^{u, t}$	0.0068$^{u, t}$	0.030$^{u, t}$	0.0068$^{u, t}$
Surface^{x}	2004	0.0095$^{u, t}$	0.0068$^{u, t}$	0.0095$^{u, t}$	0.0068$^{u, t}$	0.030$^{u, t}$	0.0068$^{u, t}$	0.030$^{u, t}$	0.0068$^{u, t}$
Subsoil^{x}	2004	0.01$^{u, t}$	0.0068$^{u, t}$	0.011$^{u, t}$	0.0068$^{u, t}$	0.030$^{u, t}$	0.0068$^{u, t}$	0.030$^{u, t}$	0.0068$^{u, t}$
Benzo*(a)*pyrene	1997	0.1^{e}		0.7^{f}		0.7^{f}		0.7^{f}	
Cadmium	1999	1.4^{b}		10^{g}		22^{b}		22^{b}	
Chromium									
Total chromium	1997	64^{b}		64^{b}		87^{b}		87^{b}	
Hexavalent chromium (VI)	1999	0.4^{h}		0.4^{h}		1.4^{h}		1.4^{h}	
Copper	1999	63^{b}		63^{b}		91^{b}		91^{b}	
Cyanide (free)	1997	0.9^{b}		0.9^{b}		8.0^{b}		8.0^{b}	
DDT (total)	1999	0.7^{i}		0.7^{i}		12$^{i, j}$		12$^{i, j}$	
Diisopropanolamine (DIPA)	2006	180^{b}		180^{b}		180^{b}		180^{b}	
Ethylbenzene									
Surface	2004	0.082^{t}	0.018$^{u, t}$	0.082^{t}	0.018$^{u, t}$	0.082^{t}	0.018$^{u, t}$	0.082^{t}	0.018$^{u, t}$
Subsoil	2004	0.082^{t}	0.018$^{u, t}$	0.082^{t}	0.018$^{u, t}$	0.082^{t}	0.018$^{u, t}$	0.082^{t}	0.018$^{u, t}$
Ethylene glycol	1999	960^{k}		960^{k}		960^{k}		960^{k}	
Lead	1999	70^{b}		140^{b}		260^{b}		600^{b}	
Mercury (inorganic)	1999	6.6^{b}		6.6^{b}		24^{b}		50^{b}	
Naphthalene	1997	0.1^{d}		0.6^{h}		22^{h}		22^{h}	
Nickel	1999	50^{l}		50^{l}		50^{l}		50^{l}	
Nonylphenol (and its ethyloxylates)	2002	5.7^{p}		5.7^{p}		14^{p}		14^{p}	
Pentachlorophenol	1997	7.6^{b}		7.6^{b}		7.6^{b}		7.6^{b}	
Phenol	1997	3.8^{b}		3.8^{b}		3.8^{b}		3.8^{b}	
Polychlorinated biphenyls (PCBs)	1999	0.5^{m}		1.3^{l}		33$^{l, j}$		33$^{l, j}$	
Polychlorinated dibenzo-*p*-dioxins/ dibenzofurans (PCDD/Fs)	2002	4 ng TEQ·kg^{-1} ^{q}		4 ng TEQ·kg^{-1} ^{q}		4 ng TEQ·kg^{-1} ^{r}		4 ng TEQ·kg^{-1} ^{s}	
Propylene glycol	2006	Insufficient information^{v}		Insufficient information^{v}		Insufficient information^{v}		Insufficient information^{v}	
Selenium	2002	1^{b}		1^{b}		3.9^{b}		3.9^{b}	

Continued

Figure 7. Concluded.

Sulfolane	2006	0.8[b]		0.8[b]		0.8[b]		0.8[b]	
Tetrachloroethylene	1997	0.1[e]		0.2[f]		0.5[f]		0.6[f]	
Thallium	1999	1[n]		1[o]		1[o]		1[o]	
Toluene									
Surface	2004	0.37[t]	0.08[t]	0.37[t]	0.08[t]	0.37[t]	0.08[t]	0.37[t]	0.08[t]
Subsoil	2004	0.37[t]	0.08[t]	0.37[t]	0.08[t]	0.37[t]	0.08[t]	0.37[t]	0.08[t]
Trichloroethylene	2006	0.01[b,u]		0.01[b,u]		0.01[b,u]		0.01[b,u]	
Vanadium	1997	130[l]		130[l]		130[i]		130[i]	
Xylenes									
Surface	2004	11[t]	2.4[t]	11[t]	2.4[t]	11[t]	2.4[t]	11[t]	2.4[t]
Subsoil	2004	11[t]	2.4[t]	11[t]	2.4[t]	11[t]	2.4[t]	11[t]	2.4[t]
Zinc	1999	200[l]		200[l]		360[l]		360[l]	

Notes: SQG_E = soil quality guideline for environmental health; SQG_{HH} = soil quality guideline for human health.

[*] For guidelines derived prior to 2004, differentiation between soil texture (coarse/fine) is not applicable.

[a] Guidelines released in 1997 were originally published in the working document entitled "Recommended Canadian Soil Quality Guidelines" (CCME 1997) and have been revised, edited, and reprinted here. Guidelines revised/released in 1999 are published here for the first time (see Table 2).

[b] Data are sufficient and adequate to calculate an SQG_{HH} and an SQG_E. Therefore the soil quality guideline is the lower of the two and represents a fully integrated de novo guideline for this land use, derived in accordance with the soil protocol (CCME 1996). The corresponding interim soil quality criterion (CCME 1991) is superseded by the soil quality guideline.

[c] Data are insufficient/inadequate to calculate an SQG_{HH}, a provisional SQG_{HH}, an SQG_E, or a provisional SQG_E. Therefore the interim soil quality criterion (CCME 1991) is retained as the soil quality guideline for this land use.

[d] Data are sufficient and adequate to calculate only a provisional SQG_E. It is greater than the corresponding interim soil quality criterion (CCME 1991). Therefore, in consideration of receptors and/or pathways not examined, the interim soil quality criterion is retained as the soil quality guideline for this land use.

[e] Data are sufficient and adequate to calculate an SQG_{HH} and a provisional SQG_E. Both are greater than the corresponding interim soil quality criterion (CCME 1991). Therefore, in consideration of receptors and/or pathways not examined, the interim soil quality criterion is retained as the soil quality guideline for this land use.

[f] Data are sufficient and adequate to calculate an SQG_{HH} and a provisional SQG_E. Both are less than corresponding interim soil quality criterion (CCME 1991). Therefore the soil quality guideline supersedes the interim soil quality criterion for this land use.

[g] The soil–plant–human pathway was not considered in the guideline derivation. If produce gardens are present or planned, a site-specific objective must be derived to take into account the bioaccumulation potential (e.g., adopt the agricultural guideline as objective). The off-site migration check should be recalculated accordingly.

[h] Data are sufficient and adequate to calculate only a provisional SQG_E, which is less than the existing interim soil quality criterion (CCME 1991). Therefore the soil quality guideline supersedes the interim soil quality criterion for this land use.

[i] Data are sufficient and adequate to calculate only an SQG_E. An interim soil quality criterion (CCME 1991) was not established for this land use, therefore the SQG_E becomes the soil quality guideline.

[j] In site-specific situations where the size and/or the location of commercial and industrial land uses may impact primary, secondary, or tertiary consumers, the soil and food ingestion guideline is recommended as the SQG_E.

[k] Data are sufficient and adequate to calculate only a provisional SQG_E.

[l] Data are sufficient and adequate to calculate only an SQG_E, which is less than the interim soil quality criterion (CCME 1991) for this land use. Therefore the SQG_E becomes the soil quality guideline, which supersedes the interim soil quality criterion for this land use.

[m] Data are sufficient and adequate to calculate only an SQG_E, which is greater than the interim soil quality criterion (CCME 1991) for this land use. Therefore the interim soil quality criterion (CCME 1991) is retained as the soil quality guideline for this land use.

[n] Data are sufficient and adequate to calculate a provisional SQG_{HH} and an SQG_E. The provisional SQG_{HH} is equal to the SQG_E and to the existing interim soil quality criterion (CCME 1991) and thus becomes the soil quality guideline, which supersedes the interim soil quality criterion for this land use.

[o] Data are sufficient and adequate to calculate a provisional SQG_{HH} and an SQG_E. The provisional SQG_{HH} is less than the SQG_E and thus becomes the soil quality guideline for this land use.

[p] Data are sufficient and adequate to calculate only an SQG_E. An interim soil quality criterion (CCME 1991) was not established for these substances, therefore, the SQG_E becomes the soil quality guideline.

[q] Data are sufficient and adequate to calculate only a provisional SQG_{HH}, which is less than the existing interim soil quality criterion (CCME 1991). Thus the provisional SQG_{HH} becomes the soil quality guideline, which supersedes the interim soil quality criterion for this land use.

[r] Data are sufficient and adequate to calculate only a provisional SQG_{HH}. An interim soil quality criterion (CCME 1991) was not established for this land use, therefore the provisional SQG_{HH} becomes the soil quality guideline.

[s] Data are sufficient and adequate to calculate only an SQG_{HH}. An interim soil quality criterion (CCME 1991) was not established for this land use, therefore the SQG_{HH} becomes the soil quality guideline.

[t] Data are sufficient and adequate to calculate an SQG_{HH} and an SQG_E. Therefore the soil quality guideline is the lower of the two and represents a fully

Figure 8. *Cyperus esculentus* in Cleveland Harbor CDF 10B dredged material.

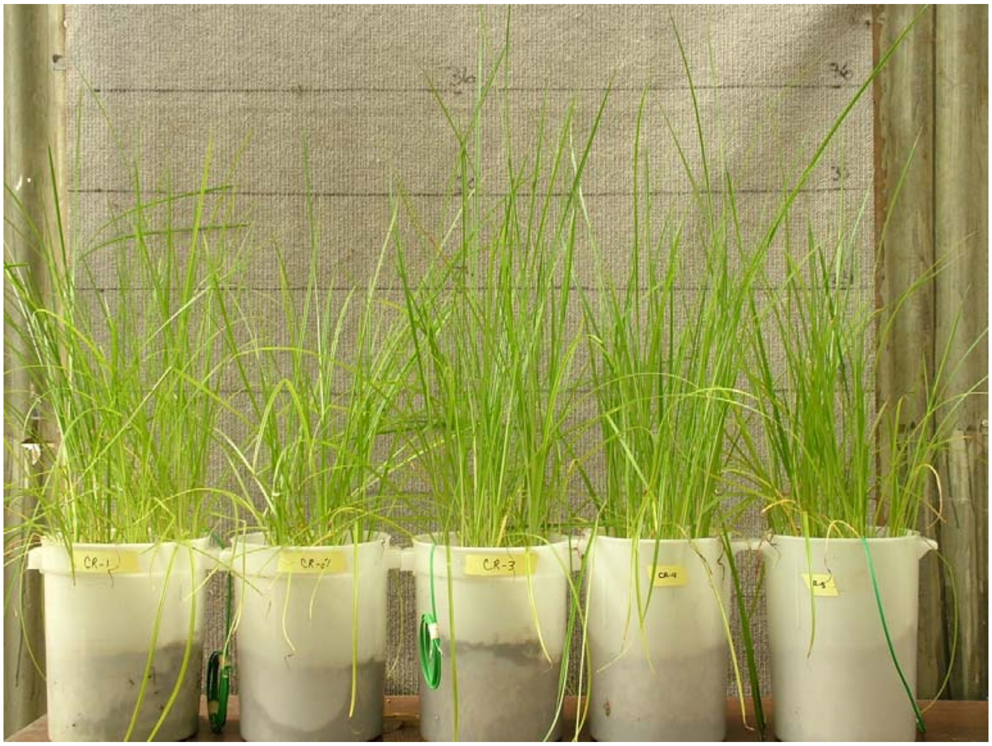


Figure 9. *Cyperus esculentus* in the Cleveland Lakefront Park Reference.

TABLES

<u>Table 1</u>: Sixteen Priority Pollutant PAHs

Acenaphthene	Acenaphthylene
Anthracene	Benzo(a)anthracene
Benzo(a)pyrene	Benzo(b)fluoranthene
Benzo(ghi)perylene	Benzo(k)fluoranthene
Chrysene	Dibenzo(a,h)anthracene
Fluoranthene	Fluorene
Indeno(1,2,3-cd)pyrene	Naphthalene
Phenanthrene	Pyrene

Table 2: Priority Pollutant Metals

Antimony	Arsenic
Beryllium	Cadmium
Chromium	Copper
Iron	Lead
Mercury	Nickel
Selenium	Silver
Thallium	Zinc

Table 3: Comparison of Average Concentrations of Constituents In Diked Pond Water with Concentrations Outside of the Dike

Constituent	Average Pond Water Concentration	Average Concentration of Background Lake Water
VOCs	µg/L	µg/L
1,4-Dichlorobenzene	<2.50E-01	<2.50E-01
Chlorobenzene	<3.20E-01	<3.20E-01
Benzene	<3.30E-01	<3.30E-01
Ethylbenzene	<2.10E-01	<2.10E-01
Toluene	<3.90E-01	<3.90E-01
B/N/A		
Acenaphthene	<4.90E-01	<4.81E-01
Anthracene	<4.90E-01	<4.81E-01
Benzo(a)anthracene	<4.90E-01	<4.81E-01
Benzo(a)pyrene	<4.90E-01	<4.81E-01
Benzo(b)fluoranthene	<4.90E-01	<4.81E-01
Benzo(ghi)perylene	<4.90E-01	<4.81E-01
Chrysene	<4.90E-01	<4.81E-01
Fluoranthene	<4.90E-01	<4.81E-01
Fluorene	<4.90E-01	<4.81E-01
Indeno(1,2,3-cd)pyrene	<4.90E-01	<4.81E-01
Phenanthrene	<4.90E-01	<4.81E-01
Pyrene	<4.90E-01	<4.81E-01
bis(2-Ethylhexyl)phthalate	<1.27E+00	<1.25E+00
Metals		
Antimony	1.40E+00	3.00E-01
Arsenic	3.90E+00	1.17E+00
Beryllium	<1.00E-01	<5.00E-2
Cadmium	1.33E-01	<4.00E-02
Chromium	2.20E+00	1.10E+00
Copper	5.87E+00	1.50E+00
Lead	4.70E+00	5.00E-01
Mercury	<5.00E-02	<5.00E-02
Nickel	7.47E+00	1.57E+00
Selenium	<6.00E-01	<6.00E-01
Silver	<4.00E-02	<4.00E-02
Thallium	<2.00E-02	<2.00E-02
Zinc	1.79E+01	2.93E+00

🟥	Pond water concentration exceeds Lake water concentration

Table 4. Comparison of Average Metal Concentrations with Ohio EPA Reference Sediment Concentrations

All units are in ppm

Metals	Average Concentration in Soils	Average Concentration in Sediments	Ohio EPA Reference Values EOLP	Ohio EPA Statewide Reference Values
Antimony	1.13E-01	2.17E-01	1.30E+00	
Arsenic	7.30E+00	2.13E+01	2.50E+01	
Beryllium	3.31E-01	9.42E-01		8.00E-01
Cadmium	8.35E-01	2.59E+00	7.90E-01	
Chromium	1.32E+01	3.74E+01	2.90E+01	
Copper	2.79E+01	6.80E+01	3.20E+01	
Lead	3.52E+01	7.99E+01		4.70E+01
Mercury	1.08E-01	1.62E-01		1.20E-01
Nickel	2.30E+01	5.01E+01	3.30E+01	
Silver	1.62E-01	7.00E-01		4.30E-01
Thallium	1.75E-01	5.61E-01		4.70E+00
Vanadium	1.08E+01	3.11E+01		4.00E+01
Zinc	1.53E+02	3.60E+02	1.60E+02	

EOLP	Erie/Ontario Lake Plains area of Ohio sediment reference value.
🟧	Exceeds Ohio EOLP reference value.
🟩	Exceeds Ohio Statewide reference value.

Table 5. Comparison of CDF sediment concentrations with lake reference sediment concentrations

	2002 Average Lake Reference Sediment, mg/kg	2002 Maximum Lake Reference Sediment, mg/kg	Maximum Concentration in Sediments mg/kg	Average Concentration in Sediments mg/kg
VOCs				
1,4-Dichlorobenzene	NA	NA	7.02E-03	3.92E-03
Chlorobenzene	NA	NA	2.68E-03	1.61E-03
Benzene	NA	NA	4.01E-03	3.26E-03
Ethylbenzene	NA	NA	3.44E-03	2.70E-03
Toluene	NA	NA	5.05E-02	3.84E-02
B/N/A				
Acenaphthene	<1.52E-02	1.60E-02	1.85E-02	<1.790E-02
Anthracene	1.90E-02	2.40E-02	3.86E-02	<3.733E-02
Benzo(a)anthracene	6.70E-02	8.70E-02	1.35E-01	1.06E-01
Benzo(a)pyrene	7.60E-02	1.00E-01	2.97E-01	2.65E-01
Benzo(b)fluoranthene	1.06E-01	1.40E-01	2.87E-01	1.97E-01
Benzo(ghi)perylene	7.60E-02	1.20E-01	2.48E-01	2.21E-01
Chrysene	7.30E-02	9.30E-02	1.94E-01	1.28E-01
Fluoranthene	1.26E-01	1.50E-01	3.23E-01	2.32E-01
Fluorene	1.20E-02	1.80E-02	1.61E-02	1.19E-02
Indeno(1,2,3-cd)pyrene	6.40E-02	9.50E-02	2.89E-01	2.66E-01
Phenanthrene	5.80E-02	6.90E-02	1.39E-01	1.10E-01
Pyrene	1.24E-01	1.50E-01	2.41E-01	1.65E-01
bis(2-Ethylhexyl)phthalate	NA	NA	4.10E-01	3.21E-01
Metals				
Antimony	9.50E-01	1.40E+00	2.41E-01	2.17E-01
Arsenic	9.50E+00	1.05E+01	2.25E+01	2.13E+01
Beryllium	1.40E+00	1.60E+00	9.65E-01	9.42E-01
Cadmium	2.30E+00	2.90E+00	2.84E+00	2.59E+00
Chromium	6.00E+01	7.08E+01	3.78E+01	3.74E+01
Copper	5.90E+01	6.83E+01	6.97E+01	6.80E+01
Lead	6.30E+01	7.28E+01	8.20E+01	7.99E+01
Mercury	4.00E-01	4.10E-01	2.09E-01	1.62E-01
Nickel	6.26E+01	7.48E+01	5.11E+01	5.01E+01
Selenium	2.40E+00	3.60E+00	1.44E+00	1.36E+00
Silver	5.20E-01	8.10E-01	7.16E-01	7.00E-01
Thallium	6.30E-01	8.30E-01	5.93E-01	5.61E-01
Zinc	2.26E+02	2.71E+02	3.66E+02	3.60E+02

🟥	Exceeds average reference concentrations
NA	Not Analysed

Table 6: Comparison of detected constituents with USEPA Region IX Preliminary Remediation Goals

All units are ppm Constituent	USEPA Region IX PRG Residential	USEPA Region IX PRG Industrial	Maximum Detection Soils	Maximum Detection Sediment	Average Concentration Soils	Average Concentration Sediments
VOCs						
1,4-Dichlorobenzene	3.40E+00	7.90E+00	1.10E-03	7.02E-03	4.86E-04	3.92E-03
Chlorobenzene	1.50E+02	5.30E+02	4.53E-04	2.68E-03	<4.01E-04	1.61E-03
Benzene	6.00E-01	1.30E+00	3.11E-03	4.01E-03	2.19E-03	3.26E-03
Ethylbenzene	8.90E+00	2.00E+01	1.58E-03	3.44E-03	1.04E-03	2.70E-03
Toluene	5.20E+02	5.20E+02	8.93E-03	5.05E-02	6.19E-03	3.84E-02
PAHs						
Acenaphthene	3.70E+03	2.90E+04	2.09E-02	1.85E-02	1.03E-02	<1.790E-02
Acenaphthylene			2.16E-02	3.86E-02	<1.983E-02	<3.733E-02
Anthracene	2.19E+04	1.00E+05	3.65E-02	3.86E-02	2.36E-02	<3.733E-02
Benzo(a)anthracene	6.21E-01	2.10E+00	9.30E-02	1.35E-01	7.53E-02	1.06E-01
Benzo(a)pyrene	6.21E-02	2.10E-01	🟩 1.69E-01	🟥 2.97E-01	🟩 1.57E-01	🟥 2.65E-01
Benzo(b)flouranthene	6.21E-01	2.10E+00	1.53E-01	2.87E-01	1.27E-01	1.97E-01
Benzo(k)flouranthene	6.20E+00	2.10E+01	2.16E-02	3.86E-02	<1.983E-02	<3.733E-02
Benzo (g,h,I)perylene			1.44E-01	2.48E-01	1.28E-01	2.21E-01
Chrysene	6.21E+01	2.10E+02	1.06E-01	1.94E-01	9.21E-02	1.28E-01
Flouranthene	2.29E+03	2.20E+04	1.93E-01	3.23E-01	1.53E-01	2.32E-01
Fluorene	2.70E+03	2.60E+04	2.35E-02	1.61E-02	1.38E-02	1.19E-02
Indeno(1,2,3-cd)Pyrene	6.21E-01	2.10E+00	1.64E-01	2.89E-01	1.49E-01	2.66E-01
Naphthalene	5.60E+01	1.90E+02	2.16E-02	3.86E-02	<1.983E-02	<3.700E-02
Phenanthrene			1.28E-01	1.39E-01	8.68E-02	1.10E-01
Pyrene	2.32E+03	2.90E+04	1.55E-01	2.41E-01	1.19E-01	1.65E-01
BNAs						
bis(2-ethylhexyl)phthalate	3.5E+01	1.2E+02	1.32E-01	4.10E-01	1.04E-01	3.21E-01
Pesticides/PCBs						
4,4'-DDE	1.7E+00	7.0E+00	2.64E-03	<4.17E-03	1.39E-03	<4.03E-03
4,4'-DDT	1.7E+00	7.0E+00	1.59E-02	<8.81E-03	7.04E-03	<8.51E-03
Aroclor-1242	2.2E-01	7.4E-01	1.00E-01	🟩 3.49E-01	3.63E-02	🟩 2.86E-01
Aroclor-1248	2.2E-01	7.4E-01	2.73E-02	<2.32E-03	9.46E-03	<2.24E-03
Aroclor-1254	2.2E-01	7.4E-01	6.19E-02	1.86E-01	2.60E-02	1.68E-01
Aroclor-1260	2.2E-01	7.4E-01	1.63E-02	7.41E-02	9.50E-03	6.25E-02
Total PCBs				6.09E-01		5.17E-01
Metals						
Antimony	3.10E+01	4.10E+02	1.67E-01	2.41E-01	1.13E-01	2.17E-01
Arsenic	3.90E-01	1.60E+00	🟥 9.06E+00	🟥 2.25E+01	🟥 7.30E+00	🟥 2.13E+01
Beryllium	1.50E+02	1.90E+03	4.27E-01	9.65E-01	3.31E-01	9.42E-01
Cadmium	3.70E+01	4.50E+02	1.32E+00	2.84E+00	8.35E-01	2.59E+00
Chromium	2.10E+02	4.50E+02	2.15E+01	3.78E+01	1.32E+01	3.74E+01
Copper	3.10E+03	4.10E+04	4.35E+01	6.97E+01	2.79E+01	6.80E+01
Lead	4.00E+02	7.50E+02	7.29E+01	8.20E+01	3.52E+01	7.99E+01
Mercury	2.30E+01	3.10E+02	2.52E-01	2.09E-01	1.08E-01	1.62E-01
Nickel	1.60E+03	2.00E+04	2.85E+01	5.11E+01	2.30E+01	5.01E+01
Selenium	3.90E+02	5.11E+03	4.32E-01	1.44E+00	3.20E-01	1.36E+00
Silver	3.91E+02	5.11E+03	3.49E-01	7.16E-01	1.62E-01	7.00E-01
Thallium	5.20E+00	6.70E+01	2.65E-01	5.93E-01	1.75E-01	5.61E-01
Zinc	2.30E+04	1.00E+05	2.65E+02	3.66E+02	1.53E+02	3.60E+02
Other						
Dioxin (2,3,7,8-TCDD)	3.9E-06	1.6E-05		2.10E-07		2.10E-07
Cyanide	1.1E+01	3.5E+01	1.03E+00	2.19E+00	5.16E-01	1.73E+00
🟩	Exceeds residential PRG					
🟥	Exceeds industrial PRG					

Table 7: Comparison of detected constituents with USEPA Biosolids Rule 503

All units are ppm

Constituent	**Biosolids Limits**	**Soil Concentration Limits**	**Maximum Detection, Soils**	**Maximum Detection, Sediment**
PAHs		NE		
Anthracene	NE	NE	3.65E-02	3.86E-02
Benzo(a)anthracene	NE	NE	9.30E-02	1.35E-01
Benzo(a)pyrene	1.50E+01	NE	1.69E-01	2.97E-01
Benzo(b)flouranthene	NE	NE	1.53E-01	2.87E-01
Chrysene	NE	NE	1.06E-01	1.94E-01
Flouranthene	NE	NE	1.93E-01	3.23E-01
Indeno(1,2,3-cd)Pyrene	NE	NE	1.64E-01	2.89E-01
Phenanthrene	NE	NE	1.28E-01	1.39E-01
Pyrene	NE	NE	1.55E-01	2.41E-01
Pesticides/PCBs				
4,4'-DDE	1.20E+00	NE	2.64E-03	<4.17E-03
4,4'-DDT	1.20E+00	NE	1.59E-02	<8.81E-03
Aroclor-1242	4.60E+00	NE	1.00E-01	3.49E-01
Aroclor-1248	4.60E+00	NE	2.73E-02	<2.32E-03
Aroclor-1254	4.60E+00	NE	6.19E-02	1.86E-01
Aroclor-1260	4.60E+00	NE	1.63E-02	7.41E-02
Metals				
Antimony	NE	NE	1.67E-01	2.41E-01
Arsenic	4.10E+01	2.05E+01	9.06E+00	2.25E+01
Beryllium	NE	NE	4.27E-01	9.65E-01
Cadmium	NE	1.95E+01	1.32E+00	2.84E+00
Chromium	NE	NE	2.15E+01	3.78E+01
Copper	1.50E+03	7.50E+02	4.35E+01	6.97E+01
Lead	3.00E+02	1.50E+02	7.29E+01	8.20E+01
Mercury	1.70E+01	8.50E+00	2.52E-01	2.09E-01
Nickel	4.20E+02	2.10E+02	2.85E+01	5.11E+01
Selenium	1.00E+02	5.00E+01	4.32E-01	1.44E+00
Silver	NE	NE	3.49E-01	7.16E-01
Thallium	NE	NE	2.65E-01	5.93E-01
Zinc	2.80E+03	1.40E+03	2.65E+02	3.66E+02
NE Not Established				
🟪	Exceeds criteria			

Table 7a: Comparison of detected constituents with USEPA Ecological Soil Screening Levels (protection of terrestrial ecosystems)

All units are ppm

Constituent	USEPA Eco SSL	Maximum Detection, Soils	Maximum Detection, Sediment	Average Concentration Soils	Average Concentration Sediments
PAHs					
Anthracene	NE	3.65E-02	3.86E-02	2.36E-02	<3.733E-02
Benzo(a)anthracene	NE	9.30E-02	1.35E-01	7.53E-02	1.06E-01
Benzo(a)pyrene	NE	1.69E-01	2.97E-01	1.57E-01	2.65E-01
Benzo(b)flouranthen	NE	1.53E-01	2.87E-01	1.27E-01	1.97E-01
Chrysene	NE	1.06E-01	1.94E-01	9.21E-02	1.28E-01
Flouranthene	NE	1.93E-01	3.23E-01	1.53E-01	2.32E-01
Indeno(1,2,3-	NE	1.64E-01	2.89E-01	1.49E-01	2.66E-01
Phenanthrene	NE	1.28E-01	1.39E-01	8.68E-02	1.10E-01
Pyrene	NE	1.55E-01	2.41E-01	1.19E-01	1.65E-01
Pesticides/PCBs					
4,4'-DDE	1.20E+00	2.64E-03	<4.17E-03	1.39E-03	<4.03E-03
4,4'-DDT	1.20E+00	1.59E-02	<8.81E-03	7.04E-03	<8.51E-03
Aroclor-1242	4.60E+00	1.00E-01	3.49E-01	3.63E-02	2.86E-01
Aroclor-1248	4.60E+00	2.73E-02	<2.32E-03	9.46E-03	<2.24E-03
Aroclor-1254	4.60E+00	6.19E-02	1.86E-01	2.60E-02	1.68E-01
Aroclor-1260	4.60E+00	1.63E-02	7.41E-02	9.50E-03	6.25E-02
Metals					
Antimony	2.90E-01	1.67E-01	2.41E-01	1.13E-01	2.17E-01
Arsenic	NE	9.06E+00	2.25E+01	7.30E+00	2.13E+01
Beryllium	3.60E+01	4.27E-01	9.65E-01	3.31E-01	9.42E-01
Cadmium	3.80E-01	1.32E+00	2.84E+00	8.35E-01	2.59E+00
Chromium	NE	2.15E+01	3.78E+01	1.32E+01	3.74E+01
Copper	NE	4.35E+01	6.97E+01	2.79E+01	6.80E+01
Lead	1.60E+01	7.29E+01	8.20E+01	3.52E+01	7.99E+01
Mercury	NE	2.52E-01	2.09E-01	1.08E-01	1.62E-01
Nickel	NE	2.85E+01	5.11E+01	2.30E+01	5.01E+01
Selenium	NE	4.32E-01	1.44E+00	3.20E-01	1.36E+00
Silver	NE	3.49E-01	7.16E-01	1.62E-01	7.00E-01
Thallium	NE	2.65E-01	5.93E-01	1.75E-01	5.61E-01
Zinc	NE	2.65E+02	3.66E+02	1.53E+02	3.60E+02
NE Not Established					
🟥	Exceeds criteria				

Table 8: Comparison of Sediment Concentrations with Consensus Threshold and Probable Effects Concentrations

Constituent	Consensus TEC (ppm DW)	Consensus PEC (ppm DW)	Maximum Sediment Detection (ppm)	Average Sediment Concentration (ppm)
Metals				
Antimony	NA	NA	2.41E-01	2.17E-01
Arsenic	9.79E+00	3.30E+01	2.25E+01	2.13E+01
Beryllium	NA	NA	9.65E-01	9.42E-01
Cadmium	9.90E-01	4.98E+00	2.84E+00	2.59E+00
Chromium	4.34E+01	1.11E+02	3.78E+01	3.74E+01
Copper	3.16E+01	1.49E+02	6.97E+01	6.80E+01
Lead	3.58E+01	1.28E+02	8.20E+01	7.99E+01
Mercury	1.80E-01	1.06E+00	2.09E-01	1.62E-01
Nickel	2.27E+01	4.86E+01	5.11E+01	5.01E+01
Selenium	NA	NA	1.44E+00	1.36E+00
Silver	NA	NA	7.16E-01	7.00E-01
Thallium	NA	NA	5.93E-01	5.61E-01
Zinc	1.21E+02	4.59E+02	3.66E+02	3.60E+02
Pesticides/PCBs				
4,4'-DDE	3.16E-03	3.13E-02	<4.17E-03	<4.03E-03
4,4'-DDT	5.28E-03	5.72E-01	<8.81E-03	<8.51E-03
Aroclor-1242	see value for total PCBs		3.49E-01	2.86E-01
Aroclor-1248	see value for total PCBs		<2.32E-03	<2.24E-03
Aroclor-1254	see value for total PCBs		1.86E-01	1.68E-01
Aroclor-1260	see value for total PCBs		7.41E-02	6.25E-02
Total PCBs	5.98E-02	6.76E-01	6.09E-01	5.17E-01
BNAs				
bis (2-ethyl hexyl) phthalate	NA	NA	4.10E-01	3.21E-01
PAHs				
Acenaphthene	NA	NA	1.85E-02	<1.79E-02
Acenaphthylene	NA	NA	3.86E-02	<3.73E-02
Anthracene	5.72E-02	8.45E-01	3.86E-02	<3.73E-02
Benzo(a)anthracene	1.08E-01	1.05E+00	1.35E-01	1.06E-01
Benzo(a)pyrene	1.50E-01	1.45E+00	2.97E-01	2.65E-01
Benzo(b)flouranthene	NA	NA	2.87E-01	1.97E-01
Benzo(k)flouranthene	NA	NA	3.86E-02	<3.73E-02
Benzo(g,h,I) perylene	NA	NA	2.48E-01	2.21E-01
Chrysene	1.66E-01	1.29E+00	1.94E-01	1.28E-01
Flouranthene	4.23E-01	2.23E+00	3.23E-01	2.32E-01
Fluorene	7.74E-02	5.36E-01	1.61E-02	1.19E-02
Naphthalene	1.76E-01	5.61E-01	3.86E-02	<3.70E-02
Indeno(1,2,3-cd)Pyrene	NA	NA	2.89E-01	2.66E-01
Phenanthrene	2.04E-01	1.17E+00	1.39E-01	1.10E-01
Pyrene	1.95E-01	1.52E+00	2.41E-01	1.65E-01
Total PAHs	1.61E+00	2.28E+01	2.34E+00	
Dioxin (2,3,7,8-TCDD)	NA	NA	2.10E-07	2.10E-07
Cyanide	NA	NA	2.19E+00	1.73E+00
NA	No sediment effects concentration available			
🟦	Exceeds Threshold Effect Concentration			
🟥	Exceeds Probable Effect Concentration			

Table 8a: Use of secondary water quality criteria and equilibrium partitioning, to estimate sediment concentrations protective of aquatic life for Organics

Constituent	Water Quality Criteria (μg/L)	Kow L/kg	Koc** L/kg	Sediment quality criteria, derived using equilibrium partitioning (μg per g OC)	Sediment quality criteria for Cleveland 10B, assuming 3.1% organic carbon content	Maximum Detection Sediment, mg/kg	Average Concentration Sediments, mg/kg
VOCs							
1,4-Dichlorobenzene	15	3311	2086	3.13E+01	9.70E-01	7.02E-03	3.92E-03
Chlorobenzene	64	6.9E+02	436	2.79E+01	8.65E-01	2.68E-03	1.61E-03
Benzene	130	1.3E+02	85	1.10E+01	3.42E-01	4.01E-03	3.26E-03
Ethylbenzene	7.3	1.4E+03	890	6.50E+00	2.01E-01	3.44E-03	2.70E-03
Toluene	9.8	6.2E+02	388	3.81E+00	1.18E-01	5.05E-02	3.84E-02
** Koc = Kow*0.63							

Table 9: Comparison of Pond Water Concentratons with EPA Environmental Water Quality Criteria for Aquatic Organisms

Constituent	CCC µg/L	CMC µg/L	Maximum Pond Water Detection µg/L	Average Pond Water Concentration µg/L
Metals				
Antimony	NA	NA	1.40E+00	1.40E+00
Arsenic	1.50E+02	3.40E+02	4.50E+00	3.90E+00
Beryllium	NA	NA	1.00E-01	<1.000E-01
Cadmium	2.50E-01	2.00E+00	2.00E-01	1.33E-01
Chromium	7.40E+01	5.70E+02	2.40E+00	2.20E+00
Copper	9.00E+00	1.30E+01	7.30E+00	5.87E+00
Lead	2.50E+00	6.50E+01	7.30E+00	4.70E+00
Mercury	7.70E-01	1.40E+00	5.00E-02	<5.000E-02
Nickel	5.20E+01	4.70E+02	7.80E+00	7.47E+00
Selenium	5.00E+00	NA	6.00E-01	<6.000E-01
Silver	NA	3.20E+00	4.00E-02	<4.000E-02
Thallium	NA	NA	2.00E-02	<2.000E-02
Zinc	1.20E+02	1.20E+02	2.54E+01	1.79E+01
VOCs				
1,4-Dichlorobenzene	*	*	<2.50E-01	<2.50E-01
Chlorobenzene	*	*	<3.20E-01	<3.20E-01
Benzene	*	*	<3.30E-01	<3.30E-01
Ethylbenzene	*	*	<2.10E-01	<2.10E-01
Toluene	*	*	<3.90E-01	<3.90E-01
Pesticides/PCBs				
4,4'-DDE	*	*	<2.14E-02	<2.14E-02
4,4'-DDT	1.00E-03	1.10E+00	<5.29E-02	<5.29E-02
Aroclor-1242	1.40E-02	NA	<5.77E-02	<5.77E-02
Aroclor-1248	1.40E-02	NA	<4.81E-02	<4.81E-02
Aroclor-1254	1.40E-02	NA	<4.81E-02	<4.81E-02
Aroclor-1260	1.40E-02	NA	<4.81E-02	<4.81E-02
Cyanide	5.2	22	1.72E+00	<1.72E+00

CMC-criteria maximum concentration; National Recommended Water Quality Criteria (Section 304(a))

CCC-criteria continuous concentration; National Recommended Water Quality Criteria (Section 304(a))

*	Only human health surface water quality criteria exist, but not established for protection of aquatic life
NA	Criteria not available.
🟧	Exceeds CMC Criteria.
🟦	Exceeds CCC Criteria.

Table 9a: Use of equilibrium partitioning to estimate water concentrations from sediment concentrations of organics

Constituent	Water Quality Criteria for Aquatic Life (µg/L)	Maximum Detected Sediment Concentration (mg/kg)	Kow L/kg	Kp** L/kg	Calculated Water Concentration (µg/L)
Total PCBs	1.40E-02	6.09E-01	1.10E+06	2.1E+04	2.84E-02
🟨	Exceeds water quality criteria				

Table 10: Comparison of Pond Water Concentratons with EPA Environmental Water Quality Criteria for Human Health

	Human Health - Consumption of Organisms only	**Maximum Pond Water Detection**	**Average Pond Water Concentration**
Constituent	**µg/L**	**µg/L**	**µg/L**
Metals			
Antimony	6.40E+02	1.40E+00	1.40E+00
Arsenic	1.40E-01	4.50E+00	3.90E+00
Beryllium	NA	<1.00E-01	<1.00E-01
Cadmium	NA	2.00E-01	1.33E-01
Chromium	NA	2.40E+00	2.20E+00
Copper	NA	7.30E+00	5.87E+00
Lead	NA	7.30E+00	4.70E+00
Mercury	NA	<5.00E-02	<5.00E-02
Nickel	4.60E+03	7.80E+00	7.47E+00
Selenium	4.20E+03	<6.00E-01	<6.00E-01
Silver	NA	4.00E-02	<4.00E-02
Thallium	4.70E-01	<2.00E-02	<2.00E-02
Zinc	2.60E+04	2.54E+01	1.79E+01
PAHs			
Anthracene	4.00E+04	<4.90E-01	<4.90E-01
Benzo(a)anthracene	1.80E-02	<4.90E-01	<4.90E-01
Benzo(a)pyrene	1.80E-02	<4.90E-01	<4.90E-01
Benzo(b)flouranthene	1.80E-02	<4.90E-01	<4.90E-01
Chrysene	1.80E-02	<4.90E-01	<4.90E-01
Flouranthene	1.40E+02	<4.90E-01	<4.90E-01
Indeno(1,2,3-cd)Pyrene	1.80E-02	<4.90E-01	<4.90E-01
Phenanthrene	NA	<4.90E-01	<4.90E-01
Pyrene	4.00E+03	<4.90E-01	<4.90E-01
VOCs			
1,4-Dichlorobenzene	1.90E+02	<2.50E-01	<2.50E-01
Chlorobenzene	1.60E+03	<3.20E-01	<3.20E-01
Benzene	5.10E+01	<3.30E-01	<3.30E-01
Ethylbenzene	2.10E+03	<2.10E-01	<2.10E-01
Toluene	1.50E+04	<3.90E-01	<3.90E-01
Pesticides/PCBs			
4,4'-DDE	2.20E-04	<2.14E-02	<2.14E-02
4,4'-DDT	2.20E-04	<5.29E-02	<5.29E-02
Aroclor-1242	6.40E-05	<5.77E-02	<5.77E-02
Aroclor-1248	6.40E-05	<4.81E-02	<4.81E-02
Aroclor-1254	6.40E-05	<4.81E-02	<4.81E-02
Aroclor-1260	6.40E-05	<4.81E-02	<4.81E-02
NA	Criteria not available.		
🟧	Exceeds Human Health Consumption Criteria.		

Table 10a: Use of equilibrium partitioning to estimate water concentrations from sediment concentrations of organics

Constituent	Water Quality Criteria for Human Health (µg/L)	Maximum Detected Sediment Concentration (mg/kg)	Kow L/kg	Kp** L/kg	Calculated Water Concentration (µg/L)	Measured Water Concentration (µg/L)
Benzo(a)anthracene	1.80E-02	1.35E-01	5.01E+05	9.8E+03	1.38E-02	<4.90E-01
Benzo(a)pyrene	1.80E-02	2.97E-01	1.10E+06	2.1E+04	1.39E-02	<4.90E-01
Benzo(b)flouranthene	1.80E-02	2.87E-01	1.58E+06	3.1E+04	9.27E-03	<4.90E-01
Chrysene	1.80E-02	1.94E-01	5.01E+05	9.8E+03	1.98E-02	<4.90E-01
4,4'-DDE	2.20E-04	4.17E-03	1.00E+06	2.0E+04	2.14E-04	<2.14E-02
4,4'-DDT	2.20E-04	8.81E-03	1.55E+06	3.0E+04	2.91E-04	<5.29E-02
Total PCBs	6.40E-05	6.09E-01	1.10E+06	2.1E+04	2.84E-02	<4.81E-02
🟨	Exceeds water quality criteria					

Table 11 Times Beach Oxidized Soil vs. Cleveland Harbor CDF 10B Oxidized Soil PAH Results

Times Beach 2001 Oxidized Soil Testing Results (units are in ppm)

Parameter	T-1 0-28	T-2 0-15	T-3 0-18	T-4 0-18	T-5 0-18	T-6 0-12
Naphthalene	0.73	0.83	0.56	0.22	1.33	0.98
Acenaphthylene	0.20	0.20	0.16	0.25	0.28	0.50
Acenaphthene	0.08	0.15	0.12	0.55	0.31	0.34
Fluorene	0.22	0.10	0.79	0.25	0.27	0.30
Phenanthrene	0.55	0.96	0.61	0.52	1.30	1.66
Anthracene	0.32	0.39	0.30	0.35	0.56	0.90
Fluoranthene	0.73	1.18	0.72	0.63	1.04	2.71
Pyrene	0.64	0.95	0.56	0.53	0.63	1.90
Benzo(a)Anthracene	0.71	0.81	0.58	0.43	0.71	2.24
Chrysene	0.73	0.79	0.56	0.38	0.71	1.91
Benzo(b)Fluoranthene	1.08	1.16	0.90	0.57	1.57	3.05
Benzo(k)Fluoranthene	0.43	0.39	0.32	0.21	0.44	1.25
Benzo(a)Pyrene	0.86	1.02	0.74	0.52	1.30	2.79
Indeno(1,2,3-cd)Pyrene	0.70	0.69	0.47	0.28	0.83	1.61
Dibenzo(a,h)Anthracene	0.22	0.23	0.24	0.09	0.34	0.29
Benzo(ghi)Perylene	0.84	0.81	0.52	0.31	0.82	1.71
Total PAH (ppm)	9.02	10.66	8.14	6.07	12.44	24.13
TOC	20,700	15,000	11,500	15,700	40,900	33,100

PAH

min	max	average
6.07	24.13	11.74

TOC

min	max	average
11,500	40,900	22,817

Cleveland CDF 10B 2004 Oxidized Soil Testing Results (units are in ppm)

	CCDF-1 Soil mg/kg	CCDF-2 Soil mg/kg	CCDF-3 Soil mg/kg
Acenaphthene	0.005	0.005	0.021
Acenaphthylene	0.010	0.011	0.009
Anthracene	0.024	0.011	0.037
Benzo(a)anthracene	0.080	0.053	0.093
Benzo(a)pyrene	0.169	0.148	0.153
Benzo(b)fluoranthene	0.153	0.094	0.135
Benzo(ghi)perylene	0.144	0.116	0.123
Benzo(k)fluoranthene	0.010	0.011	0.009
Chrysene	0.099	0.072	0.106
Dibenzo(a,h)anthracene	0.010	0.011	0.009
Fluoranthene	0.155	0.112	0.193
Fluorene	0.011	0.007	0.024
Indeno(1,2,3-cd)pyrene	0.164	0.145	0.137
Naphthalene	0.010	0.011	0.009
Phenanthrene	0.087	0.045	0.128
Pyrene	0.111	0.092	0.155
Total PAH (ppm)	1.24	0.94	1.34
TOC (ppm)	21,700	10,900	3,180

PAH

min	max	average
0.94	1.34	1.17

TOC

min	max	average
3,180	21,700	11,927

Table 12 Times Beach Reduced Soil vs. Cleveland Harbor CDF10B Sediment PAH Results

Times Beach 2001 Sediment Testing Results (units are in ppm [dry weight])

Parameter	T-9 0-24	T-10 4-30	T-11 0-8	T-11 8-30	T-12	T-13	T-14
Naphthalene	0.46	11.30	0.76	1.74	0.30	0.41	0.29
Acenaphthylene	0.22	0.26	0.24	0.32	0.42	0.56	0.49
Acenaphthene	0.66	1.01	0.17	1.20	0.42	0.56	0.49
Fluorene	0.62	0.51	0.08	0.64	0.42	0.56	0.49
Phenanthrene	2.55	2.54	0.57	2.16	0.39	0.33	0.24
Anthracene	1.79	2.83	0.52	2.18	0.26	0.25	0.21
Fluoranthene	2.49	1.03	0.55	1.31	0.52	0.42	0.31
Pyrene	1.86	0.79	0.71	1.00	0.39	0.33	0.28
Benzo(a)Anthracene	1.15	0.85	0.45	0.47	0.28	0.24	0.20
Chrysene	0.95	0.73	0.44	0.48	0.28	0.24	0.22
Benzo(b)Fluoranthene	1.04	0.91	0.64	0.34	0.41	0.35	0.37
Benzo(k)Fluoranthene	0.44	0.37	0.20	0.13	0.14	0.56	0.49
Benzo(a)Pyrene	0.84	0.81	0.57	0.27	0.29	0.24	0.23
Indeno(1,2,3-cd)Pyrene	0.39	0.41	0.35	0.13	0.17	0.56	0.49
Dibenzo(a,h)Anthracene	0.13	0.26	0.24	0.32	0.42	0.56	0.49
Benzo(ghi)Perylene	0.42	0.43	0.37	0.14	0.21	0.56	0.49
Total PAH (ppm)	16.00	25.04	6.85	12.82	5.30	6.68	5.76
TOC (ppm)	20,600	23,900	23,800	46,700	31,400	33,000	32,900

PAH		
min	max	average
5.30	25.04	11.21

TOC		
min	max	average
20,600	46,700	30,329

Cleveland CDF 10B 2004 Sediment Testing Results (units are in ppm)

PAHs	CCDF-4 Sediment mg/kg	CCDF-5 Sediment mg/kg	CCDF-6 Sediment mg/kg
Acenaphthene	0.009	0.009	0.009
Acenaphthylene	0.018	0.019	0.019
Anthracene	0.018	0.019	0.019
Benzo(a)anthracene	0.135	0.098	0.085
Benzo(a)pyrene	0.297	0.249	0.250
Benzo(b)fluoranthene	0.287	0.156	0.147
Benzo(ghi)perylene	0.248	0.214	0.201
Benzo(k)fluoranthene	0.018	0.019	0.019
Chrysene	0.194	0.095	0.095
Dibenzo(a,h)anthracene	0.018	0.019	0.019
Fluoranthene	0.323	0.197	0.176
Fluorene	0.015	0.004	0.016
Indeno(1,2,3-cd)pyrene	0.289	0.255	0.254
Naphthalene	0.018	0.019	0.019
Phenanthrene	0.139	0.098	0.093
Pyrene	0.241	0.125	0.129
Total PAH (ppm)	2.27	1.59	1.55
TOC (ppm)	34,000	30,400	30,400

PAH		
min	max	average
1.55	2.27	1.80

TOC		
min	max	average
30,400	34,000	31,600

Table 13. State of Ohio criteria for beneficial use of dredged material (from GLC, 2004).

Contaminant	Cover for Residential Use	Cover for Industrial Use	Fill, Unrestrictive
Arsenic	12[a]	41	12
Lead	140	300	70
Zinc	200	2800	200
PCBs	1.3	--	0.5
Benzo(a)pyrene	0.7	--	0.1
Benzene	0.5	--	0.05
Criteria Source	CEQG[b]	Sludge Rules[c]	CEQG[d]

a: All values are in mg kg^{-1} and applicable for the use classification.

b: Adapted from Canadian Environmental Quality Guidelines for residential soil.

c: Based on monthly average limits contained in Ohio's sewage sludge rules.

d: Adapted from Canadian Environmental Quality Guidelines for soil based on the most stringent value.

Table 14. Physical soil characteristics.

Sample	Field Moisture %	pH	Particle Size Analysis (%)			TOC
			Sand	Silt	Clay	
CDF 10B	23.6	6.8	35.8	55.0	9.2	7,500
Reference	14.9	5.7	78.3	14.2	7.5	4,500

Table 15. Soil contaminant concentrations, mg kg^{-1} dry weight.

Metals	**CDF 10B**	**Reference**	**Criteria**	**PCB/Pest**[a]	**CDF 10B**	**Reference**
As	13	6.4	12 – 41*	**1016**	<0.011	<0.0095
Cd	2.6	0.99	10 - 22**	**1221**	<0.011	<0.0095
Cr	20	7.8	218**	**1232**	<0.011	<0.0095
Cu	39	10	1127**	**1272**	<0.011	<0.0095
Hg	0.071	0.038	6.6 – 50**	**1248**	0.0805	<0.0095
Ni	28	9.3	50**	**1254**	<0.011	<0.0095
Pb	34	24	70 – 300*	**1260**	<0.011	<0.0095
Ag	<1	<1	--	**DDT**	<0.0011	<0.00095
Zn	186	47	200 – 2800*	**DDE**	0.00958	0.00077
				DDD	0.00304	<0.00095

* State of Ohio criteria for unrestricted fill (most restrictive) to cover for industrial use.

** From Canadian Environmental Quality Guidelines (2006) for residential/park – industrial.

a: State of Ohio criteria for PCBs is 0.5 mg kg^{-1} for unrestricted fill, 1.3 mg kg^{-1} for residential cover (GLC, 2004). CEQG criteria for DDT is 0.7 mg kg^{-1} for residential/park and 12.0 mg kg^{-1} for industrial.

Table 16. Plant biomass properties after 45 days of growth.

		Fresh wt. (g)	Dry wt (g)	% moisture
CDF 10B	mean	118.2	24.9	79.0
	max	139.1	31.6	80.6
	min	106.6	20.7	77.3
Reference	mean	67.2	15.6	76.8
	max	86.7	20.5	77.4
	min	51.0	11.6	76.3

Table 17. Plant tissue concentrations of metals, mg kg^{-1} dry weight.

	Replicate	As	Cd	Cr	Cu	Pb	Hg	Ni	Ag	Zn
CDF 10B	1	<0.5	1.18	<0.5	7.95	4.53	0.004	0.87	<0.5	58.65
CDF 10B	2	<0.5	1.36	<0.5	7.57	1.01	0.0042	0.91	<0.5	56.44
CDF 10B	3	<0.5	1.34	0.77	8.87	5.38	0.0057	1.35	<0.5	69.39
	Mean	**<0.50**	**1.29**	**0.07**	**8.13**	**3.64**	**0.005**	**1.04**	**<0.50**	**61.49**
Reference*	1	<0.5	3.27	<0.5	6.6	8.83	0.0037	0.92	<0.5	68.95
Reference	2	1.75	4.77	5.14	12.66	81.06	0.0036	5.12	<0.5	103.7
Reference	3	<0.5	2.97	1.07	9.82	16.02	0.0117	1.91	<0.5	74.57
	Mean	**0.25**	**3.67**	**1.90**	**9.69**	**35.30**	**0.01**	**2.65**	**<0.50**	**82.41**

Table 18. Earthworm survival and growth.

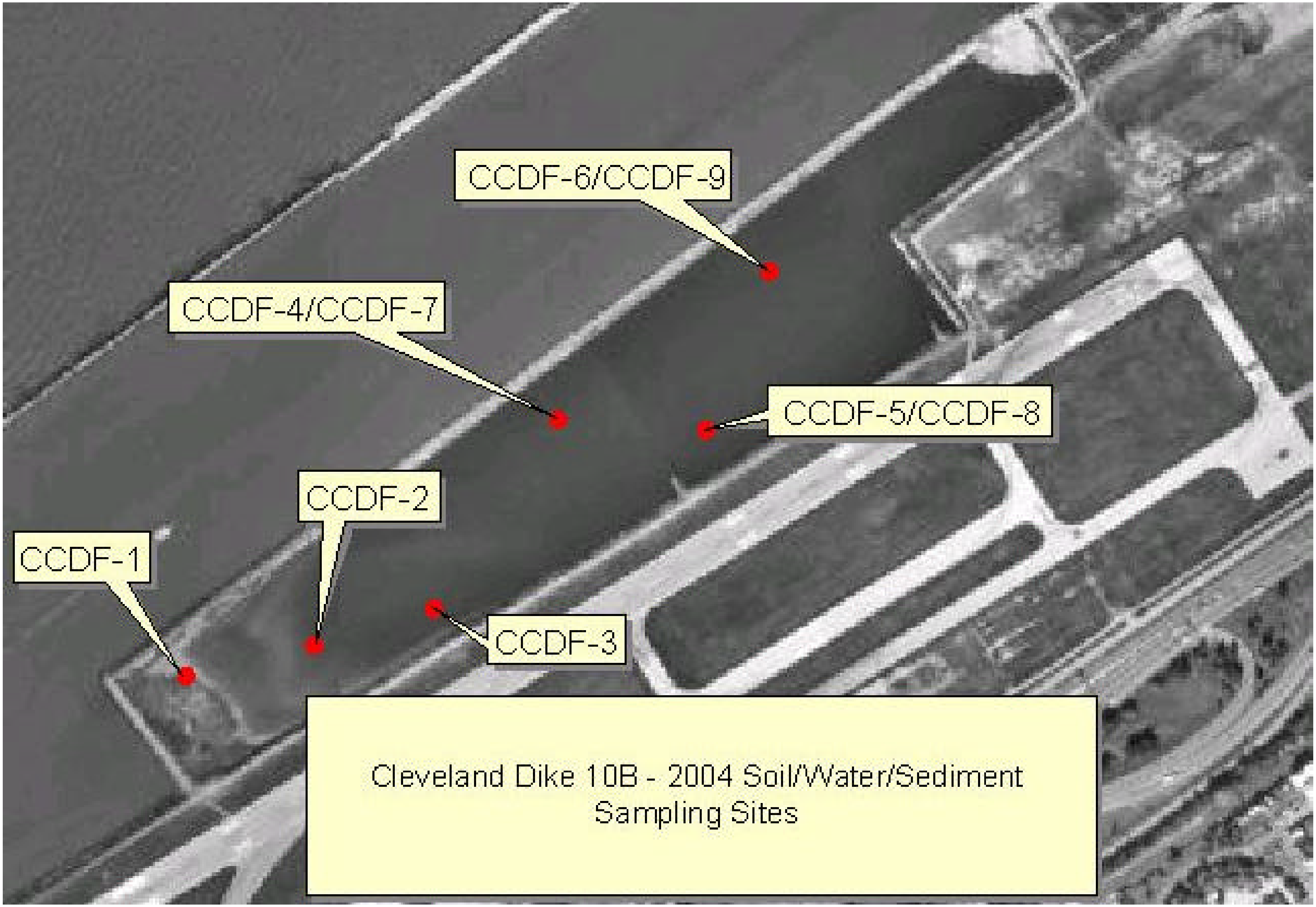
		Day 0 Count	**Day 0 wt. (g)**	**Day 28 Count**	**Day 28 wt. (g)**
CDF 10B	**mean**	**75**	**24.5**	**60.6**	**13.3**
	max		25.8	71	16.1
	min		23.8	52	9.8
Reference	**mean**	**75**	**23.7**	**70.8**	**15.5**
	max		25.5	74	16.8
	min		22.4	67	14.3
Control	**mean**	**75**	**24.5**	**65.6**	**15.4**
	max		26.3	74	20.8
	min		22.2	49	12.2

Table 19. PCB uptake by earthworms, mg kg^{-1}.

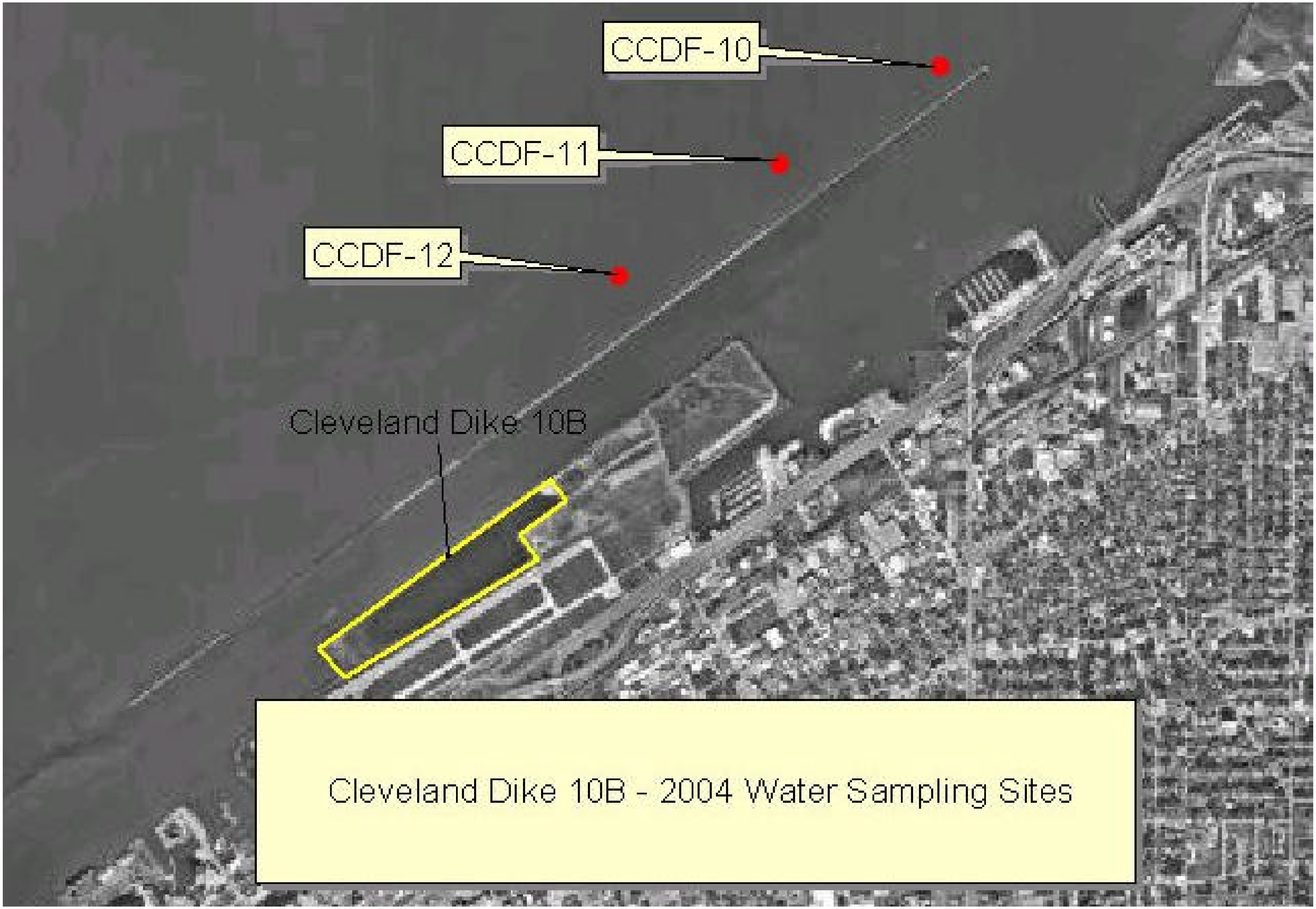
PCB/Pest	CDF 10B	Reference	Day 0 Blank
1016	<0.00777	<0.00803	<0.00793
1232	<0.00777	<0.00803	<0.00793
1248	0.041	0.0208	<0.00793
1254	<0.00777	<0.00803	<0.00793
1260	<0.00777	<0.00803	<0.00793
DDT*	0.00772	<0.0008	<0.00079
DDE	0.00474	0.00222	<0.00079
DDD	0.00339	<0.0031	<0.00079

*data for CDF 10B and Reference are questionable, calculated concentration is >40% difference between primary and secondary columns

APPENDIX A Summary tables of 2004 sampling results



Cleveland Dike 10B - 2004 Soil/Water/Sediment Sampling Sites



Cleveland Dike 10B - 2004 Water Sampling Sites

CLEVELAND CDF 10B
2004
B/N/A
SOILS/SEDIMENT DATA

B/N/A	CCDF-1 Soil ug/kg	CCDF-2 Soil ug/kg	CCDF-3 Soil ug/kg	CCDF-4 Sediment ug/kg	CCDF-5 Sediment ug/kg	CCDF-6 Sediment ug/kg
1,2,4-Trichlorobenzene	<14.8	<16.4	<14.0	<27.4	<28.3	<29.4
1,2-Dichlorobenzene	<11.7	<12.9	<11.0	<21.7	<22.4	<23.2
1,2-Diphenylhydrazine	<30.4	<33.6	<28.7	<56.3	<58.2	<60.3
1,3-Dichlorobenzene	<13.3	<14.7	<12.5	<24.5	<25.3	<26.3
1,4-Dichlorobenzene	<18.3	<20.3	<17.3	<33.9	<35.0	<36.3
2,4,6-Trichlorophenol	<32.0	<35.4	<30.2	<59.2	<61.1	<63.4
2,4-Dichlorophenol	<24.2	<26.7	<22.8	<44.8	<46.2	<47.9
2,4-Dimethylphenol	<195	<216	<184	<361	<373	<386
2,4-Dinitrophenol	<195	<216	<184	<361	<373	<386
2,4-Dinitrotoluene	<29.7	<32.8	<28.0	<54.9	<56.7	<58.7
2,6-Dinitrotolune	<39.0	<43.1	<36.8	<72.2	<74.6	<77.3
2-Chloronaphthalene	<16.0	<17.7	<15.1	<29.6	<30.6	<31.7
2-Chlorophenol	<18.0	<19.8	<16.9	<33.2	<34.3	<35.5
2-Methyl-4,6-dinitrophenol	<195	<216	<184	<361	<373	<386
2-Nitrophenol	<19.9	<22.0	<18.8	<36.8	<38.0	<39.4
3,3'-Dichlorobenzidine	<195	<216	<184	<361	<373	<386
4-Bromophenylphenylether	<39.8	<44.0	<37.6	<73.6	<76.0	<78.8
4-Chloro-3-methylphenol	<195	<216	<184	<361	<373	<386
4-Chlorophenylphenylether	<23.0	<25.4	<21.7	<42.6	<44.0	<45.6
4-Nitrophenol	<195	<216	<184	<361	<373	<386
Acenaphthene	<9.37	<10.4	20.9	<17.3	<17.9	<18.5
Acenaphthylene	<19.5	<21.6	<18.4	<36.1	<37.3	<38.6
Anthracene	23.6	<21.6	36.5	<36.1	<37.3	<38.6
Benzidine	<195	<216	<184	<361	<373	<386
Benzo(a)anthracene	80.1	52.9	93.0	135	98.1	85.3
Benzo(a)pyrene	169	148	153	297	249	250
Benzo(b)fluoranthene	153	93.8	135	287	156	147
Benzo(ghi)perylene	144	116	123	248	214	201
Benzo(k)fluoranthene	<19.5	<21.6	<18.4	<36.1	<37.3	<38.6
Butylbenzylphthalate	<33.6	<37.1	<31.7	<62.1	<64.1	<66.5

CLEVELAND CDF 10B
2004
B/N/A
WATER DATA

B/N/A	CCDF-7 Pond ug/l	CCDF-10 Background ug/l
1,2,4-Trichlorobenzene	<0.696	<0.683
1,2-Dichlorobenzene	<0.402	<0.394
1,2-Diphenylhydrazine	<0.843	<0.837
1,3-Dichlorobenzene	<0.402	<0.394
1,4-Dichlorobenzene	<0.304	<0.298
2,4,6-Trichlorophenol	<0.382	<0.375
2,4-Dichlorophenol	<0.461	<0.452
2,4-Dimethylphenol	<0.461	<0.452
2,4-Dinitrophenol	<4.90	<4.81
2,4-Dinitrotoluene	<0.686	<0.673
2,6-Dinitrotolune	<0.490	<0.481
2-Chloronaphthalene	<0.392	<0.385
2-Chlorophenol	<0.402	<0.394
2-Methyl-4,6-dinitrophenol	<0.980	<0.962
2-Nitrophenol	<0.578	<0.567
3,3'-Dichlorobenzidine	<0.500	<0.490
4-Bromophenylphenylether	<1.20	<1.17
4-Chloro-3-methylphenol	<0.676	<0.663
4-Chlorophenylphenylether	<0.824	<0.808
4-Nitrophenol	<4.90	<4.81
Acenaphthene	<0.490	<0.481
Acenaphthylene	<0.490	<0.481
Anthracene	<0.490	<0.481
Benzidine	<4.90	<4.81
Benzo(a)anthracene	<0.490	<0.481
Benzo(a)pyrene	<0.490	<0.481
Benzo(b)fluoranthene	<0.490	<0.481
Benzo(ghi)perylene	<0.490	<0.481
Benzo(k)fluoranthene	<0.490	<0.481
Butylbenzylphthalate	<0.667	<0.654

CLEVELAND CDF 10B
2004
B/N/A
SOILS/SEDIMENT DATA

B/N/As	CCDF-1 Soil ug/kg	CCDF-2 Soil ug/kg	CCDF-3 Soil ug/kg	CCDF-4 Sediment ug/kg	CCDF-5 Sediment ug/kg	CCDF-6 Sediment ug/kg
Chrysene	98.5	71.7	106	194	95.3	95.0
Di-n-butylphthalate	<28.1	<31.1	<26.5	<52.0	<53.7	<55.6
Di-n-octylphthalate	<35.5	<39.2	<33.5	<65.7	<67.8	<70.3
Dibenzo(a,h)anthracene	<19.5	<21.6	<18.4	<36.1	<37.3	<38.6
Diethylphthalate	<20.7	<22.9	<19.5	<38.3	<39.5	<41.0
Dimethylphthalate	<21.5	<23.7	<20.3	<39.7	<41.0	<42.5
Diphenylamine	<26.2	<28.9	<24.7	<48.4	<49.9	<51.8
Fluoranthene	155	112	193	323	197	176
Fluorene	11.2	6.80	23.5	15.0	<8.95	16.1
Hexachlorobenzene	<23.4	<25.9	<22.1	<43.3	<44.7	<46.4
Hexachlorobutadiene	<14.8	<16.4	<14.0	<27.4	<28.3	<29.4
Hexachlorocyclopentadiene	<195	<216	<184	<361	<373	<386
Hexachloroethane	<25.8	<28.5	<24.3	<47.6	<49.2	<51.0
Indeno(1,2,3-cd)pyrene	164	145	137	289	255	254
Isophorone	<18.7	<20.7	<17.7	<34.6	<35.8	<37.1
N-Nitrosodipropylamine	<26.5	<29.3	<25.0	<49.1	<50.7	<52.5
Naphthalene	<19.5	<21.6	<18.4	<36.1	<37.3	<38.6
Nitrobenzene	<23.8	<26.3	<22.5	<44.0	<45.5	<47.1
Pentachlorophenol	<195	<216	<184	<361	<373	<386
Phenanthrene	87.3	45.1	128	139	98.4	93.4
Phenol	<14.8	<16.4	<14.0	<27.4	<28.3	<29.4
Pyrene	111	92.1	155	241	125	129
bis(2-Chloroethoxy)methane	<14.4	<16.0	<13.6	<26.7	<27.6	<28.6
bis(2-Chloroethyl)ether	<43.7	<48.3	<41.2	<80.8	<83.5	<86.5
bis(2-Chloroisopropyl)ether	<12.9	<14.2	<12.2	<23.8	<24.6	<25.5
bis(2-Ethylhexyl)phthalate	89.6	132	89.3	410	271	283

CLEVELAND CDF 10B
2004
B/N/A
SOILS/SEDIMENT DATA

B/N/As	CCDF-7 Pond ug/l	CCDF-10 Background ug/l
Chrysene	<0.490	<0.481
Di-n-butylphthalate	<0.980	1.20
Di-n-octylphthalate	<0.853	<0.837
Dibenzo(a,h)anthracene	<0.490	<0.481
Diethylphthalate	<0.873	<0.856
Dimethylphthalate	<0.520	<0.510
Diphenylamine	<0.775	<0.760
Fluoranthene	<0.490	<0.481
Fluorene	<0.490	<0.481
Hexachlorobenzene	<0.637	<0.625
Hexachlorobutadiene	<0.314	<0.308
Hexachlorocyclopentadiene	<0.980	<0.962
Hexachloroethane	<0.422	<0.413
Indeno(1,2,3-cd)pyrene	<0.490	<0.481
Isophorone	<0.578	<0.567
N-Nitrosodipropylamine	<0.735	<0.721
Naphthalene	<0.108	<0.106
Nitrobenzene	<0.618	<0.606
Pentachlorophenol	<4.90	<4.81
Phenanthrene	<0.490	<0.481
Phenol	<0.294	<0.288
Pyrene	<0.490	<0.481
bis(2-Chloroethoxy)methane	<0.471	<0.462
bis(2-Chloroethyl)ether	<1.34	<1.32
bis(2-Chloroisopropyl)ether	<0.784	<0.769
bis(2-Ethylhexyl)phthalate	<1.27	<1.25

CLEVELAND CDF 10B
2004
METALS
SOIL/SEDIMENT DATA

Metals	CCDF-1 Soil mg/kg	CCDF-2 Soil mg/kg	CCDF-3 Soil mg/kg	CCDF-4 Sediment mg/kg	CCDF-5 Sediment mg/kg	CCDF-6 Sediment mg/kg
Aluminum	6500	3870	3700	16900	1630	15200
Antimony	0.167	0.088	0.084	0.188	0.241	0.222
Arsenic	9.06	5.63	7.20	20.7	22.5	20.8
Barium	59.0	29.4	21.7	119	119	115
Beryllium	0.427	0.284	0.283	0.959	0.965	0.903
Cadmium	1.32	0.771	0.414	2.31	2.61	2.84
Calcium	37200	7710	3310	14800	16000	15000
Chromium	21.5	9.99	8.12	37.2	37.8	37.1
Cobalt	6.79	4.62	4.58	15.4	16.2	15.6
Copper	43.5	24.1	16.2	66.2	69.7	68.1
Iron	21500	12900	14900	40000	41800	40100
Lead	72.9	21.4	11.3	77.3	82.0	80.5
Magnesium	8200	2550	1420	6630	7110	6500
Manganese	437	240	171	869	895	872
Mercury	0.252	0.061	0.012	0.126	0.152	0.209
Nickel	23.6	16.9	28.5	49.3	51.1	49.8
Potassium	1200	891	746	3120	3220	2790
Selenium	0.432	0.260	0.269	1.20	1.43	1.44
Silver	0.349	0.086	0.050	0.691	0.716	0.693
Sodium	81.8	63.4	35.5	197	195	182
Thallium	0.265	0.144	0.116	0.549	0.593	0.540
Vanadium	13.7	8.97	9.72	31.3	32.6	29.5
Zinc	265	103	90.0	356	359	366

CLEVELAND CDF 10B
2004
METALS
WATER DATA

Metals	CCDF-7 Pond ug/l	CCDF-8 Pond ug/l	CCDF-9 Pond ug/l	CCDF-10 Background ug/l	CCDF-11 Background ug/l	CCDF-12 Background ug/l
Aluminum	349	836	674	73.6	79.7	63.3
Antimony	1.4	1.4	1.4	<0.3	<0.3	<0.3
Arsenic	4.5	3.0	4.20	1.4	<1.0	1.6
Barium	49.6	44.7	45.5	17.0	17.0	17.6
Beryllium	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	0.2	0.1	0.1	<0.04	<0.04	<0.04
Calcium	62600	59400	59200	32700	32100	33200
Chromium	2.2	2.4	2.0	1.0	1.1	1.2
Cobalt	1.2	1.0	0.9	0.1	0.1	0.1
Copper	7.3	5.2	5.1	1.5	1.5	1.5
Iron	1540	1510	1370	197	214	217
Lead	7.3	3.2	3.6	0.7	0.2	0.6
Magnesium	17500	17000	16500	9690	10500	10200
Manganese	196	152	154	4.6	5.0	5.2
Mercury	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Nickel	7.8	7.5	7.1	1.5	1.6	1.6
Potassium	6180	6160	6770	1500	1390	1550
Selenium	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Silver	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Sodium	45400	45300	43500	13600	13400	14800
Thallium	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Vanadium	<5.4	<5.4	<5.4	<5.4	<5.4	<5.4
Zinc	25.4	14.1	14.3	3.5	2.4	2.9

CLEVELAND CDF 10B
2004
VOLATILES
SOILS/SEDIMENT DATA

Volatiles	CCDF-1 Soil ug/kg	CCDF-2 Soil ug/kg	CCDF-3 Soil ug/kg	CCDF-4 Sediment ug/kg	CCDF-5 Sediment ug/kg	CCDF-6 Sediment ug/kg
1,1,1-Trichloroethane	<0.435	<0.533	<0.586	<0.751	<1.37	<1.63
1,1,2,2-Tetrachloroethane	<0.747	<0.916	<1.01	<1.29	<2.35	<2.80
1,1,2-Trichloroethane	<0.443	<0.543	<0.597	<0.765	<1.39	<1.66
1,1-Dichloroethane	<0.386	<0.473	<0.520	<0.666	<1.21	<1.45
1,1-Dichloroethylene	<0.410	<0.503	<0.553	<0.708	<1.29	<1.54
1,2-Dichlorobenzene	<0.369	<0.453	<0.497	<0.637	<1.16	<1.39
1,2-Dichloroethane	<0.353	<0.433	<0.475	<0.609	<1.11	<1.32
1,2-Dichloropropane	<0.394	<0.483	<0.531	<0.680	<1.24	<1.48
1,3-Dichlorobenzene	<0.254	<0.312	<0.343	<0.439	<0.800	<0.955
1,4-Dichlorobenzene	<0.304	1.10	<0.409	<0.524	4.47	7.02
2-Chloroethylvinyl ether	<1.76	<2.15	<2.37	<0.3.03	<5.53	<6.59
Acrolein	<3.28	<4.03	<4.42	<5.67	<10.3	<12.3
Acrylonitrile	<2.29	<2.81	<3.08	<3.95	<7.20	<8.60
Benzene	3.11	2.43	1.02	2.00	3.76	4.01
Bromodichloromethane	<0.402	<0.493	<0.542	<0.694	<1.27	<1.51
Bromoform	<0.402	<0.493	<0.542	<0.694	<1.27	<1.51
Bromomethane	<0.410	<0.503	<0.553	<0.708	<1.29	<1.54
Carbon tetrachloride	<0.402	<0.493	<0.542	<0.694	<1.27	<1,51
Chlorobenzene	<0.336	<0.413	<0.453	1.61	<1.06	2.68
Chloroethane	<0.665	<0.815	<0.895	<1.15	<2.09	<2.50
Chloroform	<0.427	<0.523	<0.575	<0.737	<1.34	<1.60
Chloromethane	<0.304	<0.372	<0.409	<0.524	<0.955	<1.14
Dibromochloromethane	<0.410	<0.503	<0.553	<0.708	<1.29	<1.54
Ethylbenzene	1.34	1.58	<0.420	1.60	3.05	3.44
Methylene chloride	<1.11	<1.36	<1.49	<1.91	<3.49	<4.16
Tetrachloroethene	<0.312	<0.382	<0.420	<0.538	<0.981	<1.17
Toluene	8.47	8.93	1.16	16.4	50.5	48.4
Trichloroethene	<0.369	<0.453	<0.497	<0.637	<1.16	<1.39
Vinyl chloride	<0.460	<0.564	<0.619	<0.793	<1.45	<1.73
cis-1,2-Dichloropropylene	<0.353	<0.433	<0.475	<0.609	<1.11	<1.32
trans-1,2-Dichloroethylene	<0.435	<0.533	<0.586	<0.751	<1.37	<1.63
trans-1,2-Dichloropropylene	<0.205	<0.252	<0.276	<0.354	<0.646	<0.770

CLEVELAND CDF 10B
2004
VOLATILES
WATER DATA

Volatiles	CCDF-7 Pond ug/l	CCDF-10 Background ug/l
1,1,1-Trichloroethane	<0.340	<0.340
1,1,2,2-Tetrachloroethane	<0.490	<0.490
1,1,2-Trichloroethane	<0.440	<0.440
1,1-Dichloroethane	<0.410	<0.410
1,1-Dichloroethylene	<0.410	<0.410
1,2-Dichlorobenzene	<0.360	<0.360
1,2-Dichloroethane	<0.290	<0.290
1,2-Dichloropropane	<0.250	<0.250
1,3-Dichlorobenzene	<0.330	<0.330
1,4-Dichlorobenzene	<0.250	<0.250
2-Chloroethylvinyl ether	<1.25	<1.25
Acrolein	<4.06	<4.06
Acrylonitrile	<2.00	<2.00
Benzene	<0.330	<0.330
Bromodichloromethane	<0.380	<0.380
Bromoform	<0.500	<0.500
Bromomethane	<0.500	<0.500
Carbon tetrachloride	<0.290	<0.290
Chlorobenzene	<0.320	<0.320
Chloroethane	<0.500	<0.500
Chloroform	<0.360	<0.360
Chloromethane	<0.500	<0.500
Dibromochloromethane	<0.290	<0.290
Dichlorodifluoromethane	<0.430	<0.430
Ethylbenzene	<0.210	<0.210
Methylene chloride	<1.90	<1.90
Tetrachloroethene	<0.330	<0.330
Toluene	<0.390	<0.390
Trichloroethylene	<0.360	<0.360
Trichlorofluoromethane	<0.500	<0.500
Vinyl chloride	<0.550	<0.550
cis-1,2-Dichloropropylene	<0.300	<0.300
trans-1,2-Dichloroethylene	<0.370	<0.370
trans-1,2-Dichloropropylene	<0.290	<0.290

CLEVELAND CDF 10B
2004
PESTICIDES
SOILS/SEDIMENT DATA

Pesticides	CCDF-1 Soil ug/kg	CCDF-2 Soil ug/kg	CCDF-3 Soil ug/kg	CCDF-4 Sediment ug/kg	CCDF-5 Sediment ug/kg	CCDF-6 Sediment ug/kg
4,4'-DDD	<1.23	<1.36	<2.32	<4.55	<4.70	<4.87
4,4'-DDE	<1.05	2.64	<1.99	<3.90	<4.03	<4.17
4,4-DDT	<2.23	15.9	<4.20	<8.23	<8.50	<8.81
Aldrin	<1.01	<1.11	<1.90	<3.72	<3.84	<3.98
alpha-BHC	<0.676	<0.747	<1.28	<2.50	<2.58	<2.68
beta-BHC	<0.555	<0.614	<1.05	<2.05	<2.12	<2.20
Chlordane	<38.9	<43.0	<73.5	<144	<149	<154
delta-BHC	<0.555	<0.614	<1.05	<2.05	<2.12	<2.20
Dieldrin	<1.01	<1.11	<1.90	<3.72	<3.84	<3.98
Endosulfan I	<0.469	<0.519	<0.886	<1.74	<1.79	<1.86
Endosulfan II	<0.906	<1.00	<1.71	<3.35	<3.46	<3.59
Endosulfan sulfate	<1.07	<1.19	<2.03	<3.97	<4.10	<4.25
Endrin	<1.18	<1.30	<2.23	<4.37	<4.51	<4.68
Endrin aldehyde	<1.18	<1.30	<2.23	<4.37	<4.51	<4.68
gamma-BHC (Lindane)	<0.487	<0.539	<0.919	<1.80	<1.86	<1.93
Heptachlor	<0.621	<0.686	<1.17	<2.30	<2.37	<2.46
Heptachlor epoxide	<0.526	<0.581	<0.992	<1.95	<2.01	<2.08
Toxaphene	<73.2	<80.9	<138	<271	<280	<290

CLEVELAND CDF 10B
2004
PESTICIDES
WATER DATA

Pesticides	CCDF-7 Pond ug/l	CCDF-10 Background ug/l
4,4'-DDD	<0.0267	<0.00505
4,4'-DDE	<0.0214	<0.00404
4,4-DDT	<0.0529	<0.010
Aldrin	<0.0255	<0.00482
alpha-BHC	<0.00704	<0.00133
beta-BHC	<0.0138	<0.00261
Chlordane	<0.752	<0.132
delta-BHC	<0.0133	<0.00252
Dieldrin	<0.0187	<0.00353
Endosulfan I	<0.0299	<0.00564
Endosulfan II	<0.0575	<0.0109
Endosulfan sulfate	<0.0226	<0.00427
Endrin	<0.0184	<0.00349
Endrin aldehyde	<0.0337	<0.00638
gamma-BHC (Lindane)	<0.0102	<0.00193
Heptachlor	<0.0284	<0.00537
Heptachlor epoxide	<0.0146	<0.00275
Toxaphene	<0.510	<0.0963

CLEVELAND CDF 10B
2004
PCB
SOILS/SEDIMENT DATA

PCBs	CCDF-1 Soil ug/kg	CCDF-2 Soil ug/kg	CCDF-3 Soil ug/kg	CCDF-4 Sediment ug/kg	CCDF-5 Sediment ug/kg	CCDF-6 Sediment ug/kg
Aroclor 1016	<1.17	<1.29	<1.10	<2.17	<2.24	<2.32
Aroclor 1221	<3.30	<3.65	<3.12	<6.11	<6.31	<6.54
Aroclor 1232	<1.95	<2.16	<1.84	<3.61	<3.73	<3.86
Aroclor 1242	8.20	<1.29	100	324	184	349
Aroclor 1248	<1.17	27.3	<1.10	<2.17	<2.24	<2.32
Aroclor 1254	3.40	12.8	61.9	163	156	186
Aroclor 1260	6.70	5.50	16.3	60.7	52.8	74.1

CLEVELAND CDF 10B
2004
PCB
WATER DATA

PCBs	CCDF-7 Pond ug/l	CCDF-10 Background ug/l
Aroclor 1016	<0.0481	<0.0481
Aroclor 1221	<0.0801	<0.0801
Aroclor 1232	<0.0481	<0.0481
Aroclor 1242	<0.0577	<0.0577
Aroclor 1248	<0.0481	<0.0481
Aroclor 1254	<0.0481	<0.0481
Aroclor 1260	<0.0481	<0.0481

CLEVELAND CDF 10B
2004
TOTAL ORGANIC CARBON
SOILS/SEDIMENT DATA

Total Organic Carbon mg/kg	CCDF-1 Soil	CCDF-2 Soil	CCDF-3 Soil	CCDF-4 Sediment	CCDF-5 Sediment	CCDF-6 Sediment
	21,700	10,900	3,180	34,000	30,400	30,400

CLEVELAND CDF 10B
2004
TOTAL CYANIDE
SOILS/SEDIMENT DATA

Total Cyanide ug/kg	CCDF-1 Soil	CCDF-2 Soil	CCDF-3 Soil	CCDF-4 Sediment	CCDF-5 Sediment	CCDF-6 Sediment
	1,030	186	331	1,990	2,190	1,020

CLEVELAND CDF 10B
2004
TOTAL CYANIDE
WATER DATA

Total Cyanide ug/l	CCDF-7 Pond	CCDF-8 Pond	CCDF-9 Pond	CCDF-10 Background	CCDF-10 Background	CCDF-10 Background
	<1.72	<1.72	<1.72	<1.72	<1.72	<1.72

CLEVELAND CDF 10B
2004
DIOXIN
SOILS/SEDIMENT DATA

2,3,7,8-TCDD pg/g	CCDF-4 Sediment
	0.210

APPENDIX F

SEDIMENT SAMPLING RESULTS

Table 3.2. Particle size distribution of Cleveland Harbor Federal navigation channel sediments (from EEI 2007).

Particle Size Distribution	Harbor Sediments																
	Sampling Sites																
	CH-1	CH-2	CH-3	CH-4	CH-5	CH-6	CH-7	CH-8	CH-9	CH-10	CH-11	CH-12	CH-13	CH-14	CH-15	CH-16	CH-17
Clay	8.1	11.2	12.6	10.6	8.4	15.1	15.3	11.2	25.4	25.2	31.1	25.8	33.1	23.4	28.7	26.9	32.9
Silt	27.6	34.1	35.4	39.6	36.6	56.2	55.2	68.4	71.3	68.3	62	71.2	65.2	72.1	66.8	67.8	53.5
Sand	64.3	54.7	52	49.8	55	28.7	29.5	20.4	3.3	6.5	6.9	3	1.7	4.5	4.5	5.3	13.6
Gravel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Particle Size Distribution	Harbor Sediments													Open-Lake Reference Area Sediments			
	Sampling Sites													Sampling Sites			
	CH-18	CH-19	CH-20	CH-21	CH-22	CH-23	CH-24	CH-25	CH-26	CH-27	CH-28	CH-29	CH-30	CL-1	CL-2	CL-3	CL-4
Clay	24.1	18.6	12.6	14.3	28.2	38	26.3	25	36.9	48.9	46.3	45	30.3	33.8	28	38	33.7
Silt	69.4	73.6	29.2	22.3	32	53.5	70.6	72.2	58.3	50.2	51.1	53.5	60.6	64.7	70.9	60.7	64.6
Sand	6.5	2.8	56.5	63.4	39.8	8.5	3.1	2.8	4.8	0.9	2.6	1.5	9.1	1.5	1.1	1.3	1.7
Gravel	0	0	1.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 3.3 Bulk inorganic analyses on Cleveland Harbor Federal navigation channel sediments CH1 through CH17 (from EEI 2007).

	Harbor Sediments																
	Sampling Sites																
Metal (mg/kg)	**CH-1**	**CH-2**	**CH-3**	**CH-4**	**CH-5**	**CH-6**	**CH-7**	**CH-8**	**CH-9**	**CH-10**	**CH-11**	**CH-12**	**CH-13**	**CH-14**	**CH-15**	**CH-16**	**CH-17**
Aluminum	6850	5860	6910	7720	7180	9040	8690	7950	11400	9130	10900	12800	13800	10300	9030	9560	10700
Antimony	0.895J*	0.782J	0.786J	0.849J	1.47U**	0.523J	1.55U	0.508J	**11**	1.31J	0.179U	0.157U	0.169U	0.146U	0.86	0.157U	0.180U
Arsenic	10.4	9.33	**11.1**	**14.1**	**12.5**	**14.5**	**16.8**	**12.8**	**17.4**	**13.7**	**16.1**	**20.3**	**20.2**	**19.4**	**14.5**	**14.3**	**14.4**
Barium	52.7	41.6	60	56.8	55.1	66.6	67.2	58.1	87.7	69.2	72.9	84	91.5	74.6	62.2	65.5	82.7
Beryllium	0.438J	0.387J	0.456J	0.553J	0.476J	0.561J	0.555U	0.515J	0.719J	0.571J	0.67	0.76	0.82	0.62	0.55	0.59	0.65
Cadmium	0.664J	0.456J	0.8	0.687J	0.577J	0.593J	0.311U	0.633J	1.31J	0.619J	0.99	0.96	1.6	1	0.37	0.47	1.2
Calcium	10400	10400	**13200**	**13700**	**14000**	**15100**	**14700**	**12500**	**18200**	**14200**	**15500**	**16300**	**19800**	**14200**	**13700**	**14500**	**16400**
Chromium	19.9	14.8	20.7	22.2	19.4	23.4	21.3	22.6	36	24.2	31	30.7	37.4	23.2	22.3	23	35.1
Cobalt	7.77	6.46	8.11	9.35	8.36	10.1	10.1	9.19	12.5	10.2	11.1	11.8	**14.2**	10.4	10	10.1	10.8
Copper	43.2	**55.5**	**56**	48.2	46.2	50.6	43.3	52.8	**67.8**	49.2	48.5	50.1	**67.6**	42.3	40.8	43.2	52
Iron	21000	18900	22800	27700	26000	30200	30300	27600	34100	29800	33100	35500	**42000**	33600	30600	32000	32100
Lead	36	26.1	41.6	39.8	36.7	41.8	38.9	38.2	**66.3**	41.3	45.4	43.9	62.3	37.9	36.4	41.7	45.9
Magnesium	4100	3370	4620	5090	4870	5700	5710	5070	6990	5640	7430	7780	8000	6590	5720	6170	6450
Manganese	455	397	485	498	517	661	576	462	580	525	528	585	580	512	443	434	486
Mercury	0.0855	0.0733	0.0708	0.0759	0.0702	**2.88**	0.0624	0.081	0.105	0.128	0.0793	0.0884	0.126	0.104	0.0766	0.0835	0.123
Nickel	25	34.7	28	31.7	31.2	31.4	29.7	27.7	39.1	30.9	34.1	34.4	41.4	29.4	28.5	28.7	31.2
Potassium	912	703	859	1000	926	1160	1070	988	1370	1230	1360	1560	1720	1180	1120	1180	1340
Selenium	0.752J	2.25U	1.46J	2.40U	1.5J	1.52J	2.34	1.72J	**13.9U**	1.62J	0.894U	0.785U	0.843U	0.729U	2	1.4	1.3
Silver	0.182J	0.155J	0.764U	0.802U	0.4J	0.198J	0.776U	0.194J	0.927U	0.192J	0.200J	0.26	0.33	0.250J	0.250J	0.2	0.33
Sodium	**232**	**207**	**224**	**222**	**198**	**254**	**216**	**214**	**304**	**247**	**269**	**236**	**328**	**232**	**255**	**252**	**269**
Thallium	2.91U	1.26J	1.36J	3.21U	1.03J	3.26U	1.14	1.07J	**18.5U**	3.31U	0.300J	0.42	0.49	0.37	1.9	1.8	0.360J
Vanadium	14.3	12.6	14.6	17.8	15.9	18.4	18.5	16.5	23.1	19.5	21	22.9	26.6	19.9	18.1	18.8	20.3
Zinc	156	130	137	193	170	189	167	**296**	**428**	**226**	**323**	243	**417**	194	216	**236**	**379**

	Harbor Sediments																
	Sampling Sites																
Misc. (mg/kg)	**CH-1**	**CH-2**	**CH-3**	**CH-4**	**CH-5**	**CH-6**	**CH-7**	**CH-8**	**CH-9**	**CH-10**	**CH-11**	**CH-12**	**CH-13**	**CH-14**	**CH-15**	**CH-16**	**CH-17**
Ammonia	48	98.7	**201**	69.4	66.9	101	90.6	68.7	116	**195**	89.9	101	105	99.7	91.1	98.3	153
Total cyanide	0.117J	0.104J	0.355J	0.197J	0.101J	0.469	0.116J	0.492	0.531	0.430U	0.195J	0.190J	0.499	0.3J	0.548	**1.03**	**1.08**
TOC	14200	20500	21200	21900	20100	25200	24100	17300	26500	27400	22900	20300	28000	14000	14500	14500	22300

*Estimated value between the detection limit and reporting limit.

**Not detected at or above the specified reporting limit.

Boldface/shaded values indicate a concentration that is greater in comparison to the open-lake reference area.

Table 3.4 Bulk inorganic analyses on Cleveland Harbor Federal navigation channel sediments CH18 through CH30 and CL1 through CL4 (from EEI 2007).

Metal (mg/kg)	Harbor Sediments													Open-Lake Reference Area			
	Sampling Sites													Sampling Sites			
	CH-18	CH-19	CH-20	CH-21	CH-22	CH-23	CH-24	CH-25	CH-26	CH-27	CH-28	CH-29	CH-30	CL-1	CL-2	CL-3	CL-4
Aluminum	9680	10600	5420	6460	10400	10800	9080	11700	9630	9490	11900	17200	11700	16600	19700	18600	17500
Antimony	**6.7**	0.190J	0.84	0.56	0.7	0.193U	1.2	**4.8**	1	0.197U	0.198U	0.239U	1.5	3.77U	3.87U	3.76U	3.74U
Arsenic	**16.3**	**16.5**	7.3	8.5	**15**	**12.8**	**15.9**	**20.2**	**12.8**	10	**13.8**	**17.5**	**12.9**	11	9.75	9.35	8.54
Barium	79.5	79.2	36.2	51.9	78.2	64.5	70.1	85.6	60.5	56.7	78	108	78.9	108	123	115	110
Beryllium	0.63	0.77	0.37	0.42	0.65	0.67	0.58	0.72	0.59	0.56	0.74	1.1	0.89	1.02J	1.22J	1.1J	1.07J
Cadmium	**3.4**	0.99	0.41	0.92	1.2	1	0.71	0.94	0.8	0.64	1.2	1.4	1.4	1.77J	1.97	1.78J	1.77J
Calcium	**14100**	**19500**	**22800**	**17400**	379	10300	11300	**13700**	9820	7130	11000	12000	9560	11900	12100	11300	10700
Chromium	41.5	26.1	14.8	21.2	38.3	27.2	23.8	26.9	24.4	22.1	31.3	44.5	36.2	46.6	55.7	49.6	49.9
Cobalt	11.5	10.8	6.1	5.6	9.7	11.1	10.2	12.2	10.3	9.3	12.2	**15.3**	11.4	12.8	14.1	13.7	12.8
Copper	**58.8**	47	24	32.5	**69.6**	38	48	47.1	40	32	49.8	**56.6**	53	46.6	53.4	49.2	47.1
Iron	30000	34400	18100	17700	34100	30100	28900	35900	29400	25000	33100	**45600**	**39800**	34100	39500	36800	35100
Lead	**71.5**	41.4	27.9	37.1	**127**	38.5	41	40.1	37.9	30.2	50.3	62.2	61.4	53.3	65.9	57.5	59.3
Magnesium	6160	9120	9350	6000	**12600**	5870	5320	6750	5590	4740	6740	9010	6580	10700	11500	10700	10100
Manganese	502	551	251	238	471	538	507	758	479	420	561	832	512	833	650	584	618
Mercury	0.151	0.0663	0.0352	0.0626	0.0177	0.0128	0.0763	0.0942	0.0118	0.0109	0.0122	0.0164	0.0211	0.253	0.294	0.286	0.345
Nickel	40.9	32.9	18.1	18.2	33.3	32.2	30.7	35.3	29.4	26.3	36.4	46.2	35.6	51	57.6	54.2	53.5
Potassium	1190	1250	710	808	1220	1540	1150	1450	1260	1360	154	2230	1560	2420	2790	2660	2490
Selenium	0.772U	0.744U	0.91	0.734U	1.5	2	1.7	0.792U	0.915U	1.4	1.1	1.19U	3.6	5.66U	3.94J	2.14J	5.60U
Silver	0.45	0.19	0.120J	0.170J	0.270J	0.330J	0.260J	0.280J	0.300J	0.43	0.31	0.53	0.75	1.89U	1.93U	1.88U	1.87U
Sodium	**252**	159	174	**445**	**306**	**203**	179	180	138	170	151	188	174	189	196	181	184
Thallium	0.49	6.2	0.240J	0.230J	0.47	0.6	0.46	0.42	0.38	0.58	0.57	0.51	0.82	7.55U	7.74U	7.52U	7.47U
Vanadium	21.2	21.7	12.2	11.7	19.8	22.1	19.4	23.4	19.3	18	23.5	33.5	25	36.7	43	40.6	38.5
Zinc	**339**	207	132	211	**307**	205	208	193	203	173	**259**	**299**	**238**	185	217	199	196

Misc. (mg/kg)	Harbor Sediments													Open-Lake Reference Area			
	Sampling Sites													Sampling Sites			
	CH-18	CH-19	CH-20	CH-21	CH-22	CH-23	CH-24	CH-25	CH-26	CH-27	CH-28	CH-29	CH-30	CL-1	CL-2	CL-3	CL-4
Ammonia	133	108	51.5	102	120	152	140	**190**	139	**165**	126	127	82	158	142	132	118
Total cyanide	**1.05**	0.111U	0.481	**2.62**	**3.63**	0.131U	0.189J	0.289J	0.121U	0.144U	0.148U	0.161U	0.153U	0.997U	1.01U	0.979U	0.965U
TOC	19900	17500	12500	6850	6780	26300	20700	20400	19400	15600	20400	15600	40000	30100	30600	29600	27000

*Estimated value between the detection limit and reporting limit.

**Not detected at or above the specified reporting limit.

Boldface/shaded values indicate a concentration that is greater in comparison to the open-lake reference area.

Table 3.5 Bulk Polycyclic Aromatic Hydrocarbon (PAH) analyses on Cleveland Harbor Federal navigation channel sediments CH1 through CH17 (from EEI 2007).

PAH Compound (ug/kg)	**Harbor Sediments**																
	Sampling Sites																
	CH-1	**CH-2**	**CH-3**	**CH-4**	**CH-5**	**CH-6**	**CH-7**	**CH-8**	**CH-9**	**CH-10**	**CH-11**	**CH-12**	**CH-13**	**CH-14**	**CH-15**	**CH-16**	**CH-17**
Acenaphthene	16.9	10.6	9.89	31.8	32.1	46.6	24.3	18.3	6.86	14.2	9.36	25.8	14.6	29.4	14.5	21.8	17.4
Acenaphthylene	16.2	11.4	8.24	32	30.3	42	14.4	15.2	5.88	12.1	6.84	20.5	11.7	24.7	12.7	18.5	18.4
Anthracene	61.3	27.6	31.3	117	134	137	74.8	64	20.8	39.5	19.7	65.5	32.9	83.5	36.1	44.1	50.9
Benzo(a)Anthracene	213	112	142	449	424	558	270	216	102	170	84.9	224	123	355	154	168	167
Benzo(a)Pyrene	262	136	163	495	426	628	268	227	122	196	99.1	266	148	401	191	205	190
Benzo(b)Flouranthene	352	203	260	814	719	948	391	356	204	340	166	449	272	695	338	347	291
Benzo(ghi)Perylene	141	77.6	91.9	273	242	340	144	116	72.6	117	56.7	160	98.4	248	117	113	96.1
Benzo(k)Fluoranthene	131	67.1	72.3	204	165	340	135	96.5	63.5	95.8	49.2	136	79.1	202	97.3	116	97.3
Chrysene	274	149	171	594	509	657	301	246	129	225	100	312	168	497	219	231	203
Dibenz(a,h)Anthracene	38.9	21	28.7	79.2	71.8	102	39.9	33.1	21.6	31.7	16.4	43.9	26.4	69.1	32.1	36.9	30.1
Fluoranthene	534	287	334	1020	991	1310	612	487	254	419	210	548	306	863	390	400	355
Fluorene	26.9	15.2	15.3	48.8	47.4	71.6	32.7	28.7	10.2	22.2	13.2	39.9	21.3	45.2	21.8	30.2	23.1
Indeno(1,2,3-cd)Pyrene	126	70.6	84.6	257	224	314	135	106	65.9	103	51.2	144	87.4	231	109	102	91.1
Naphthalene	4.08U*	3.94U	4.47U	4.61U	6.82U	22.1U	4.79U	4.39U	5.45U	5.06U	5.03U	17.2U	5.28U	25U	5U	5.13U	5.2U
Phenanthrene	258	138	154	522	488	618	327	269	106	199	89.4	290	135	429	176	187	155
Pyrene	452	223	271	909	825	1070	508	414	202	352	159	453	240	734	317	340	296
Total PAHs	**2903**	**1549**	**1837**	**5846**	**5329**	**7182**	**3277**	**2693**	**1386**	**2337**	**1131**	**3178**	**1764**	**4907**	**2226**	**2361**	**2081**

*Not detected at or above the specified reporting limit.
Boldface/shaded values indicate a concentration that is greater in comparison to the open-lake reference area.

Table 3.6. Bulk Polycyclic Aromatic Hydrocarbon (PAH) analyses on Cleveland Harbor Federal navigation channel sediments CH18 through CH30 and CL1 through CL4 (from EEI 2007).

PAH compound (ug/kg)	Harbor Sediments													Open-Lake Reference Area			
	Sampling Sites													Sampling Sites			
	CH-18	CH-19	CH-20	CH-21	CH-22	CH-23	CH-24	CH-25	CH-26	CH-27	CH-28	CH-29	CH-30	CL-1	CL-2	CL-3	CL-4
Acenaphthene	54.8	11.5	38.2	12.5	23.1	14.8	22	8.07	14.5	15.5	19.4	13	46.4	10.7U*	11.9U	12U	6.48
Acenaphthylene	47	12.9	20.3	12.4	22.7	12.5	20.7	9	25.1	16.9	23.8	30.8	50.4	10.7U	6.12	12U	13.5
Anthracene	122	33.4	59.1	31.8	70.7	41.9	63.9	24.6	40.6	42.3	38.4	41.3	145	10.7U	8.61	12U	18.4
Benzo(a)Anthracene	379	131	182	127	236	136	283	102	138	165	107	131	510	16.8	45.2	39.6	57.2
Benzo(a)Pyrene	417	159	205	142	222	141	327	112	165	192	126	152	478	10.7U	15.5	10.5	75.5
Benzo(b)Fluoranthene	677	253	315	242	338	239	586	202	242	346	187	232	818	10.7U	17.9	11.5	103
Benzo(ghi)Perylene	249	86.2	107	75.7	114	74.9	206	64.3	83.5	117	68.2	80.2	224	10.7U	6.38	12U	46.3
Benzo(k)Fluoranthene	193	86.1	106	58.1	91.9	60.9	156	51.4	60.7	94.6	69.2	66.4	221	10.7U	9.83	10.5	44.2
Chrysene	466	168	221	143	244	136	375	113	127	202	114	122	593	10.7U	11.9U	12U	40.1
Dibenz(a,h)Anthracene	75.5	26.4	33	21.8	38.6	23.1	60.2	19	26.2	33.3	22.9	25.8	74.5	10.7U	11.9U	12U	11.6
Fluoranthene	815	318	387	256	404	283	662	247	237	367	214	237	1040	13.2	34.3	25.5	122
Fluorene	84.4	17.7	39.7	18.4	37.1	23.1	35.3	12.3	21	26.7	25.9	22.8	73.9	10.7U	11.9U	12U	11.1
Indeno(1,2,3-cd)Pyrene	227	83	99.1	67.5	105	69.1	194	59.3	79.4	106	65.9	78.7	212	10.7U	11.9U	12U	41.7
Naphthalene	38	4.86U	77.4	4.06U	3.25	6.26U	4.81U	5.31U	5.42U	6.45U	6.26U	7.6U	39.2	10.7U	11.9U	12U	11.5U
Phenanthrene	465	143	220	114	206	141	324	103	120	156	78	97.3	515	10.7U	11.9U	12U	14.8
Pyrene	714	260	357	248	393	227	563	193	197	292	167	185	1020	10.7U	7.19	12U	87.2
Total PAHs	**5024**	**1789**	**2467**	**1570**	**2549**	**1623**	**3878**	**1320**	**1577**	**2172**	**1327**	**1515**	**6060**	30	151	97.6	693.08

*Not detected at or above the specified reporting limit.

Boldface/shaded values indicate a concentration that is greater in comparison to the open-lake reference area.

Table 3.7. Bulk Polychlorinated Biphenyl (PCB) analyses on Cleveland Harbor Federal navigation channel sediments CH1 through CH30 and CL1 through CL4 (from EEI 2007).

	Harbor Sediments																
	Sampling Sites																
Aroclor (ug/kg)	CH-1	CH-2	CH-3	CH-4	CH-5QC	CH-6	CH-7	CH-8	CH-9	CH-10	CH-11	CH-12	CH-13	CH-14	CH-15	CH-16	CH-17
1016	58.1U*	60.7U	63.8U	67.3U	63.8U	66.8U	63.9U	29.3U	36.9U	34.5U	35.9U	32.9U	38.0U	32.2U	32.5U	34.0U	36.0U
1221	58.1U	60.7U	63.8U	67.3U	63.8U	66.8U	63.9U	29.3U	36.9U	34.5U	35.9U	32.9U	38.0U	32.2U	32.5U	34.0U	36.0U
1232	58.1U	60.7U	63.8U	67.3U	63.8U	66.8U	63.9U	29.3U	36.9U	34.5U	35.9U	32.9U	38.0U	32.2U	32.5U	34.0U	36.0U
1242	58.8	56.2J**	61.6J	56.3J	**111**	51.6J	53.2J	29.3U	36.9U	34.5U	35.9U	32.9U	38.0U	32.2U	32.5U	34.0U	36.0U
1248	58.1U	60.7U	63.8U	67.3U	63.8U	66.8U	63.9U	29.3U	36.9U	34.5U	35.9U	32.9U	38.0U	32.2U	32.5U	34.0U	36.0U
1254	**163**	**75**	**63.2J**	**68**	**126**	**48.2J**	42.8J	22.2J	28.1J	30.1J	33.8J	32.9U	38.0U	32.2U	32.5U	34.0U	**46.7**
1260	29.1J	60.7U	63.8U	67.3U	32.4J	66.8U	63.9U	29.3U	36.9U	34.5U	35.9U	32.9U	38.0U	32.2U	32.5U	34.0U	27.1J
"Total"***	**251**	**192**	**189**	**192**	**269**	**167**	**160**	**80.8**	**102**	**101**	**106**	**98.7**	**114**	**96.6**	**97.5**	**102**	**110**

	Harbor Sediments													Open-Lake Reference Area Sediments			
	Sampling Sites													Sampling Sites			
Aroclor (ug/kg)	CH-18	CH-19	CH-20	CH-21	CH-22	CH-23	CH-24	CH-25	CH-26	CH-27QC	CH-28	CH-29	CH-30	CL-1	CL-2	CL-3	CL-4
1016	68.3U	65.3U	55.1U	60.9U	71.9U	77.8U	66.6U	76.4U	75.5U	90.3U	86.7U	48.8U	91.7U	78.6U	81.1U	77.1U	77.7U
1221	68.3U	65.3U	55.1U	60.9U	71.9U	77.8U	66.6U	76.4U	75.5U	90.3U	86.7U	48.8U	91.7U	78.6U	81.1U	77.1U	77.7U
1232	68.3U	65.3U	55.1U	60.9U	71.9U	77.8U	66.6U	76.4U	75.5U	90.3U	86.7U	48.8U	91.7U	78.6U	81.1U	77.1U	77.7U
1242	53.4J	43.7J	79.5	55.7J	47.7J	68.9J	60.8J	46.6J	**99.7**	**163**	**147**	48.8U	**83.0J**	78.6U	81.1U	77.1U	77.7U
1248	68.3U	65.3U	55.1U	60.9U	71.9U	77.8U	66.6U	76.4U	75.5U	90.3U	86.7U	48.8U	91.7U	78.6U	81.1U	77.1U	77.7U
1254	**56.6J**	65.3U	**73.5**	**80.9**	**75.5**	**85.3**	**64.4J**	38.7J	**138**	**260**	**221**	**62.1**	**102**	36.6J	42.8J	35.4J	37.9J
1260	68.3U	65.3U	55.1U	34.4J	30.5J	77.8U	66.6U	76.4U	44.9J	81J	62.6J	31.0J	44.4J	78.6U	81.1U	77.1U	77.7U
"Total"	**179**	**174**	**208**	**171**	**153**	**232**	**192**	**162**	**283**	**504**	**431**	**142**	**230**	36.6	42.8	35.4	37.9

*Not detected at or above the specified reporting limit.

**Estimated value between the detection limit and reporting limit.

***Sum of aroclor(s) evidenced in harbor or lake sediments, with non-detectable concentrations valued at the reporting limit.

Boldface/shaded values indicate a concentration that is greater in comparison to the open-lake reference area.

Table 3.8 Bulk pesticide analyses on Cleveland Harbor Federal navigation channel sediments CH1 through CH17 (from EEI 2007).

	Harbor Sediments																
	Sampling Sites																
Pesticide (ug/kg)	**CH-1**	**CH-2**	**CH-3**	**CH-4**	**CH-5**	**CH-6**	**CH-7**	**CH-8**	**CH-9**	**CH-10**	**CH-11**	**CH-12**	**CH-13**	**CH-14**	**CH-15**	**CH-16**	**CH-17**
4,4-DDD	4.70J*	6.07U**	6.38U	22.4U	20.0U	4.95J	2.13U	19.8U	8.16J	14.9J	2.38J	2.21J	2.58U	3.05	2.20U	2.06J	2.42U
4,4-DDE	5.81U	6.07U	6.38U	22.4U	20.0U	6.68U	2.13U	19.8U	24.9U	11.1J	7.19U	5.54	2.58U	2.18U	2.20U	2.28U	4.36
4,4-DDT	5.81U	6.07U	6.38U	**60.6**	**55.7**	10.2	11.3	19.8U	10.7J	11.7J	7.19U	9.52	11.6	9.9	10.3	13.1	2.42U
Aldrin	2.91U	3.03U	3.19U	11.2U	10.0U	3.34U	1.07U	9.90U	12.5U	11.6U	3.59U	1.11U	1.29U	1.09U	1.10U	1.14U	1.21U
Alpha-BHC	2.91U	3.03U	3.19U	11.2U	10.0U	3.34U	1.07U	9.90U	12.5U	11.6U	3.59U	1.11U	1.29U	1.09U	1.10U	1.14U	1.21U
Beta-BHC	2.91U	3.03U	3.19U	11.2U	10.0U	3.34U	1.07U	9.90U	12.5U	11.6U	3.59U	1.11U	1.29U	1.09U	1.10U	1.31	2.07
Chlordane	36.3U	37.9U	39.9U	140U	125U	41.8U	13.3U	124U	156U	145U	44.9U	16.8U	16.1U	13.7U	13.7U	14.3U	15.1U
Delta-BHC	2.91U	3.03U	3.19U	11.2U	10.0U	3.34U	1.07U	9.90U	12.5U	11.6U	3.59U	1.11U	1.29U	1.09U	1.10U	1.14U	1.21U
Dieldrin	5.81U	6.07U	6.38U	22.4U	20.0U	6.68U	2.13U	19.8U	24.9U	**11.6**	7.19U	2.21U	2.58U	1.09U	2.20U	2.28U	2.42U
Endosulfan I	2.91U	6.07U	3.19U	11.2U	10.0U	3.34U	1.07U	9.90U	12.5U	11.6U	3.59U	1.11U	1.29U	1.09U	1.10U	2.28U	1.21U
Endosulfan II	2.91U	3.03U	6.38U	22.4U	20.0U	6.68U	2.13U	19.8U	24.9U	11.2J	7.19U	2.21U	2.58U	2.18U	2.20U	1.14U	2.42U
Endosulfan Sulfate	5.81U	6.07U	6.38U	22.4U	20.0U	6.68U	2.13U	19.8U	24.95U	11.6U	7.19U	2.21U	2.58U	2.18	2.20U	2.28U	2.42U
Endrin	5.81U	6.07U	6.38U	22.4U	20.0U	6.68U	2.13U	19.8U	24.9U	23.2U	7.19U	2.21U	2.58	1.09U	2.20U	2.28U	2.42U
Endrin Aldehyde	2.91U	6.07U	6.38U	22.4U	20.0U	6.68U	2.13U	19.8U	24.9U	7.23J	7.19U	2.21U	2.58U	2.18U	2.20U	2.28U	2.42U
Endrin Ketone	5.81U	6.07U	6.38U	22.4U	20.0U	6.68U	2.13U	19.8U	24.9U	8.34J	7.19U	2.21U	2.58U	2.18U	2.20U	1.14U	2.42U
Gamma-BHC	2.91U	3.03U	3.19U	11.2U	10.0U	3.34U	1.07U	9.90U	12.5U	11.6U	3.59U	1.11U	1.29U	1.09U	1.10U	1.14U	1.21U
Gamma-Chlordane	2.91U	3.03U	3.19U	11.2U	10.0U	3.34U	1.07U	9.90U	12.5U	11.6U	3.59U	1.11U	1.29U	1.09U	1.10U	1.14U	1.21U
Heptachlor	2.91U	3.03U	3.19U	11.2U	10.0U	3.34U	1.07U	9.90U	12.5U	11.6U	3.59U	1.11U	1.29U	1.09U	1.10U	1.14U	1.21U
Heptachlor Epoxide	2.91U	3.03U	3.19U	11.2U	10.0U	3.34U	1.07U	9.90U	12.5U	11.6U	3.59U	1.11U	1.29U	1.09U	1.10U	1.14U	1.21U
Methoxychlor	29.1U	30.3U	31.9U	112U	100U	33.4U	10.77U	99.0U	125U	36J	35.9U	11.1U	12.9U	10.9U	11.0U	1.14U	12.1U
Toxaphene	145U	152U	159U	561U	501U	167U	53.3U	495U	623U	579U	180U	55.3U	64.5U	54.6U	55.0U	57.0U	60.4U

*Estimated value between the detection limit and reporting limit.
**Not detected at or above the specified reporting limit.
Boldface/shaded values indicate a concentration that is greater in comparison to the open-lake reference area.

Table 3.9 Bulk pesticides analyses on Cleveland Harbor Federal navigation channel sediments CH18 through CH30 and CL1 through CL4 (from EEI 2007).

	Harbor Sediments													Open-Lake Reference Area			
	Sampling Sites													Sampling Sites			
Pesticide (ug/kg)	**CH-18**	**CH-19**	**CH-20**	**CH-21**	**CH-22**	**CH-23**	**CH-24**	**CH-25**	**CH-26**	**CH-27**	**CH-28**	**CH-29**	**CH-30**	**CL-1**	**CL-2**	**CL-3**	**CL-4**
4,4-DDD	2.28U	6.53U	5.51U	2.03U	7.19U	7.78JU	6.66J	7.64J	7.55J	8.85J	**13.5**	9.82J	**12.5**	7.89J	8.95J	15.5U	7.92J
4,4-DDE	2.28U	6.53U	5.51U	2.03U	7.19U	7.78U	6.66U	7.64U	7.55U	8.85U	8.67U	9.82U	9.17U	15.8U	16.2U	15.5U	15.6U
4,4-DDT	2.28U	6.53U	5.51U	2.03U	7.19U	7.78U	6.66U	7.64U	7.55U	8.85U	12.7	9.82U	9.17U	15.8U	16.2U	15.5U	15.6U
Aldrin	1.14U	3.27U	2.75U	1.02U	3.59U	3.89U	3.33U	3.82U	3.78U	4.43U	4.33U	4.91U	4.58U	7.89U	8.09U	7.76U	7.80U
Alpha-BHC	1.14U	3.27U	2.75U	1.02U	3.59U	3.89U	3.33U	3.82U	3.78U	4.43U	4.33U	4.91U	4.58U	7.89U	8.09U	7.76U	7.80U
Beta-BHC	1.14U	3.27U	2.75U	1.02U	3.59U	3.89U	3.33U	3.82U	3.78U	4.43U	4.33U	4.91U	4.58U	7.89U	8.09U	7.76U	7.80U
Chlordane	14.2U	40.8U	34.4U	12.7U	44.9U	48.6U	41.6U	47.7U	47.2U	55.3U	54.2U	61.4U	57.3U	98.7U	101U	97.0U	97.5U
Delta-BHC	1.14U	3.27U	2.75U	1.02U	3.59U	3.89U	3.33U	3.82U	3.78U	4.43U	4.33U	4.91U	4.58U	7.89U	8.09U	7.76U	7.80U
Dieldrin	2.28U	6.53U	5.51U	2.03U	7.19U	7.78U	6.66U	7.64U	7.55U	8.85U	8.67U	9.82U	9.17U	15.8U	16.2U	15.5U	15.6U
Endosulfan I	1.14U	3.27U	2.75U	1.02U	3.59U	3.89U	3.33U	3.82U	3.78U	4.43U	4.33U	4.91U	4.58U	7.89U	8.09U	7.76U	7.80U
Endosulfan II	2.28U	6.53U	5.51U	2.03U	7.19U	7.78U	6.66U	7.64U	7.55U	8.85U	8.67U	9.82U	9.17U	15.8U	16.2U	15.5U	15.6U
Endosulfan Sulfate	2.28U	6.53U	5.51U	2.03U	7.19U	3.89U	6.66U	7.64U	7.55U	8.85U	8.67U	9.82U	9.17U	15.8U	16.2U	15.5U	15.6U
Endrin	2.28U	6.53U	5.51U	2.03U	7.19U	7.78U	6.66U	7.64U	7.55U	8.85U	8.67U	9.82U	9.17U	15.8U	16.2U	15.5U	15.6U
Endrin Aldehyde	2.28U	6.53U	5.51U	2.03U	7.19U	7.78U	6.66U	7.64U	7.55U	8.85U	8.67U	9.82U	9.17U	15.8U	16.2U	15.5U	15.6U
Endrin Ketone	2.28U	6.53U	5.51U	2.03U	7.19U	7.78U	6.66U	7.64U	7.55U	8.85U	8.67U	9.82U	9.17U	15.8U	16.2U	7.76U	15.6U
Gamma-BHC	1.14U	3.27U	2.75U	1.02U	3.59U	3.89U	3.33U	3.82U	3.78U	4.43U	4.33U	4.91U	4.58U	7.89U	8.09U	7.76U	7.80U
Gamma-Chlordane	1.14U	3.27U	2.75U	1.02U	3.59U	3.89U	3.33U	3.82U	3.78U	4.43U	4.33U	4.91U	4.58U	15.8U	16.2U	15.5U	15.6U
Heptachlor	1.14U	3.27U	2.75U	1.02U	3.59U	3.89U	3.33U	3.82U	3.78U	4.43U	4.33U	4.91U	4.58U	7.89U	8.09U	15.5U	7.80U
Heptachlor Epoxide	1.14U	3.27U	2.75U	1.02U	3.59U	3.89U	3.33U	3.82U	3.78U	4.43U	4.33U	4.91U	4.58U	7.89U	8.09U	7.76U	7.80U
Methoxychlor	11.4U	32.7U	27.5U	10.2U	35.9U	38.9U	33.3U	38.2U	37.8U	44.3U	43.3U	49.1U	45.8U	78.9U	80.9U	77.6U	78.0U
Toxaphene	56.9U	163U	138U	50.8U	180U	195U	166U	191U	189U	221U	217U	245U	229U	395U	405U	388U	390U

*Not detected at or above the specified reporting limit.

**Estimated value between the detection limit and reporting limit.

Boldface/shaded values indicate a concentration that is greater in comparison to the open-lake reference area.

Table 3.10 Inorganic Modified Elutriate Test results on Cleveland Harbor Federal navigation sediments (from EEI 2007).

	Harbor Sediments									
	Sampling Sites									
	CH-UEMU		CH-URMU		CH-LRMU		CH-OHMU		CH-ORMU	
Metal (µg/L)	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**
Aluminum	4970	51.4	4970	126	2940	35.1	4530	46.9	3810	69
Antimony	1.3	0.89	2.3	0.85	1.7	1.1	0.5U	0.5U	0.8	0.75
Arsenic	16	4.6	13	9.4	16	12.1	10	4	7	4.1
Barium	81.9	32.3	83.2	46.4	82.2	59.1	104	67.7	53.4	30.2
Beryllium	0.42	0.1U*	0.31	0.1U	0.19	0.1U	0.2	0.1U	0.22	0.1U
Cadmium	0.88	0.11U	1.7	0.11U	1.1	0.11U	0.34	0.11U	0.39	0.11U
Calcium	49900	45900	55700	55400	59800	57800	44600	44200	36600	36100
Chromium	15.9	1U	17.8	1U	11	1U	7.3	1U	9.1	1U
Cobalt	5.1	1.2	4	1.6	2.5	1.1	2.8	1.1	2.1	1.2
Copper	37.5	1.3	27.9	1.5	18.1	0.66	11	1.1	13	1.5
Iron	13200	267	9090	582	5930	651	6280	245	5560	199
Lead	33.2	0.5U	30.3	0.77	20.9	0.5U	11.9	0.5U	13.8	0.5U
Magnesium	13300	11400	13500	13600	13800	13300	10800	10400	9820	8600
Manganese	748	323	430	396	591	509	1660	1530	248	157
Mercury	0.0398	0.0012	0.0391	0.0024	0.0267	0.0017	0.0212	0.00099	0.0251	0.0011
Nickel	20.6	4.1	17.3	5.4	11.7	4	9.1	3	8.2	2.2
Potassium	8030	6460	7750	7230	7080	6810	5010	4290	4520	3620
Selenium	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
Sodium	22100	21200	25500	29900	28600	25000	20700	18500	22500	23400
Thallium	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.3U	0.51	0.3U
Vanadium	14.1	3U	7.4	3U	4.8	3U	5.2	3U	4.5	3U
Zinc	131	3.4	163	7.4	103	2.8	48.5	3.3	61.2	6.6

	CH-UEMU		CH-URMU		CH-LRMU		CH-OHMU		CH-ORMU	
Misc. (mg/L)	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**
Ammonia	6.06	5.93	11	9.37	8.74	8.67	7.52	7.32	5.22	7.22
Total cyanide	0.00232J	0.00226J	0.0021J	0.00361J	0.0015U	0.0038	0.005U	0.00331U	0.00237J	0.0034J

*Not detected at or above the specified reporting limit.

**Estimated value between the detection limit and reporting limit.

Table 3.11 PAH Modified Elutriate Test results on Cleveland Harbor Federal navigation sediments (from EEI 2007).

	Harbor Sediments									
	Sampling Sites									
	CH-UEMU		CH-URMU		CH-LRMU		CH-OHMU		CH-ORMU	
PAH compound (µg/L)	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Acenaphthene	0.481U*	0.521U	0.485U	0.521U	0.197J**	0.521U	0.481U	0.521U	0.472U	0.521U
Acenaphthylene	0.481U	0.521U	0.485U	0.521U	0.481U	0.521U	0.481U	0.521U	0.472U	0.521U
Anthracene	0.481U	0.521U	0.485U	0.521U	0.481U	0.521U	0.481U	0.521U	0.472U	0.521U
Benzo(a)Anthracene	0.104	0.0786	0.127	0.0776	0.149	0.156	0.0839	0.0855	0.091	0.0784
Benzo(a)Pyrene	0.113	0.0917	0.152	0.0961	0.168	0.181	0.122	0.112	0.137	0.0957
Benzo(b)Fluoranthene	0.201	0.184	0.36	0.125	0.223	0.405	0.241	0.129	0.23	0.118
Benzo(ghi)Perylene	0.106	0.0871	0.142	0.0704	0.129	0.143	0.0762	0.0698	0.0693	0.0609
Benzo(k)Fluoranthene	0.024U	0.026U	0.0243U	0.026U	0.024U	0.026U	0.024U	0.026U	0.105	0.026U
Chrysene	0.134	0.113	0.17	0.0929	0.167	0.172	0.0918	0.0851	0.0922	0.0786
Dibenz(a,h)Anthracene	0.0481U	0.0521U	0.0485U	0.0521U	0.0481U	0.0521U	0.0481U	0.0521U	0.472U	0.0521U
Fluoranthene	0.287	0.234	0.379	0.169	0.411	0.254	0.213	0.149	0.134	0.0989
Fluorene	0.481U	0.521U	0.485U	0.521U	0.123J	0.521U	0.481U	0.521U	0.472U	0.521U
Indeno(1,2,3-cd)Pyrene	0.0481U	0.0521U	0.0485U	0.0521U	0.0481U	0.0521U	0.0481U	0.0521U	0.0472U	0.0521U
Naphthalene	0.481U	0.521U	0.485U	0.521U	0.481U	0.521U	0.481U	0.521U	0.472U	0.521U
Phenanthrene	0.481U	0.521U	0.294J	0.521U	0.258J	0.521U	0.481U	0.521U	0.472U	0.521U
Pyrene	0.303	0.249	0.444	0.203	0.506	0.386	0.268	0.159	0.237	0.154

*Not detected at or above the specified reporting limit.

**Estimated value between the detection limit and reporting limit.

Table. 3.12 PCB Modified Elutriate Test results on Cleveland Harbor Federal navigation sediments (from EEI 2007).

	Harbor Sediments									
	Sampling Sites									
	CH-UEMU		CH-URMU		CH-LRMU		CH-ORMU		CH-OHMU	
Aroclor (µg/L)	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
1016	0.0952U*	0.0106U	0.100U	0.103U	0.0952U	0.104U	0.098U	0.103U	0.0962U	0.0102U
1221	0.0952U	0.0106U	0.100U	0.103U	0.0952U	0.104U	0.098U	0.103U	0.0962U	0.0102U
1232	0.0952U	0.0106U	0.100U	0.103U	0.0952U	0.104U	0.098U	0.103U	0.0962U	0.0102U
1242	0.0952U	0.0106U	0.100U	0.103U	0.0952U	0.104U	0.098U	0.103U	0.0962U	0.0102U
1248	0.0952U	0.0106U	0.100U	0.103U	0.0952U	0.104U	0.098U	0.103U	0.0962U	0.0102U
1254	0.0952U	0.0106U	0.100U	0.103U	0.0952U	0.104U	0.098U	0.103U	0.0962U	0.0102U
1260	0.0952U	0.0106U	0.100U	0.103U	0.0952U	0.104U	0.098U	0.103U	0.0962U	0.0102U

*Not detected at or above the specified reporting limit.

Table 3.13 Pesticide Modified Elutriate Test results on Cleveland Harbor Federal navigation sediments (from EEI 2007).

	Harbor Sediments									
	Sampling Sites									
	CH-UEMU		CH-URMU		CH-LRMU		CH-OHMU		CH-ORMU	
Pesticide (µg/L)	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**
4,4-DDD	0.189U	0.222U	0.200U	0.222U	0.192U	0.222U	0.0388U	0.0444U	0.196U	0.222U
4,4-DDE	0.189U	0.222U	0.200U	0.222U	0.192U	0.222U	0.0388U	0.0444U	0.196U	0.222U
4,4-DDT	0.189U	0.222U	0.200U	0.222U	0.192U	0.222U	0.0388U	0.0444U	0.196U	0.222U
Aldrin	0.0943U	0.111U	0.100U	0.111U	0.0962U	0.111U	0.0194U	0.0222U	0.098U	0.111U
Alpha-BHC	0.0943U	0.111U	0.100U	0.111U	0.0962U	0.111U	0.0194U	0.0222U	0.098U	0.111U
Alpha-Chlordane	0.0943U	0.111U	0.100U	0.111U	0.0962U	0.111U	0.0194U	0.0222U	0.098U	0.111U
Beta-BHC	0.0943U	0.111U	0.100U	0.111U	0.192U	0.111U	0.0194U	0.0222U	0.098U	0.111U
Chlordane	1.18U	1.39U	1.25U	1.39U	1.20U	1.39U	0.243U	0.278U	1.23U	1.39U
Delta-BHC	0.0943U	0.111U	0.100U	0.111U	0.0962U	0.111U	0.0194U	0.0222U	0.098U	0.111U
Dieldrin	0.189U	0.222U	0.200U	0.222U	0.192U	0.222U	0.0388U	0.0444U	0.196U	0.222U
Endosulfan I	0.0943U	0.111U	0.100U	0.111U	0.0962U	0.111U	0.0194U	0.0222U	0.098U	0.111U
Endosulfan II	0.189U	0.222U	0.200U	0.222U	0.192U	0.222U	0.0388U	0.0444U	0.196U	0.222U
Endosulfan Sulfate	0.189U	0.222U	0.200U	0.222U	0.192U	0.222U	0.0388U	0.0444U	0.196U	0.222U
Endrin	0.189U	0.222U	0.200U	0.222U	0.192U	0.222U	0.0388U	0.0444U	0.196U	0.222U
Endrin Aldehyde	0.189U	0.222U	0.200U	0.222U	0.192U	0.222U	0.0388U	0.0444U	0.196U	0.222U
Endrin Ketone	0.189U	0.222U	0.200U	0.222U	0.192U	0.222U	0.0388U	0.0444U	0.196U	0.222U
Gamma-BHC	0.0943U	0.111U	0.100U	0.111U	0.0962U	0.111U	0.0194U	0.0222U	0.098U	0.111U
Gamma-Chlordane	0.0943U	0.111U	0.200U	0.111U	0.0962U	0.111U	0.0194U	0.0444U	0.098U	0.111U
Heptachlor	0.0943U	0.111U	0.100U	0.111U	0.0962U	0.111U	0.0194U	0.0222U	0.098U	0.111U
Heptachlor Epoxide	0.0943U	0.111U	0.100U	0.111U	0.0962U	0.111U	0.0194U	0.0222U	0.098U	0.111U
Methoxychlor	0.943U	1.11U	0.100U	1.11U	0.962U	1.11U	0.194U	0.222U	2.45U	1.11U
Toxaphene	2.36U	2.78U	2.50U	2.78U	2.40U	2.78U	0.485U	0.556U	2.45U	2.78U

*Not detected at or above the specified reporting limit.

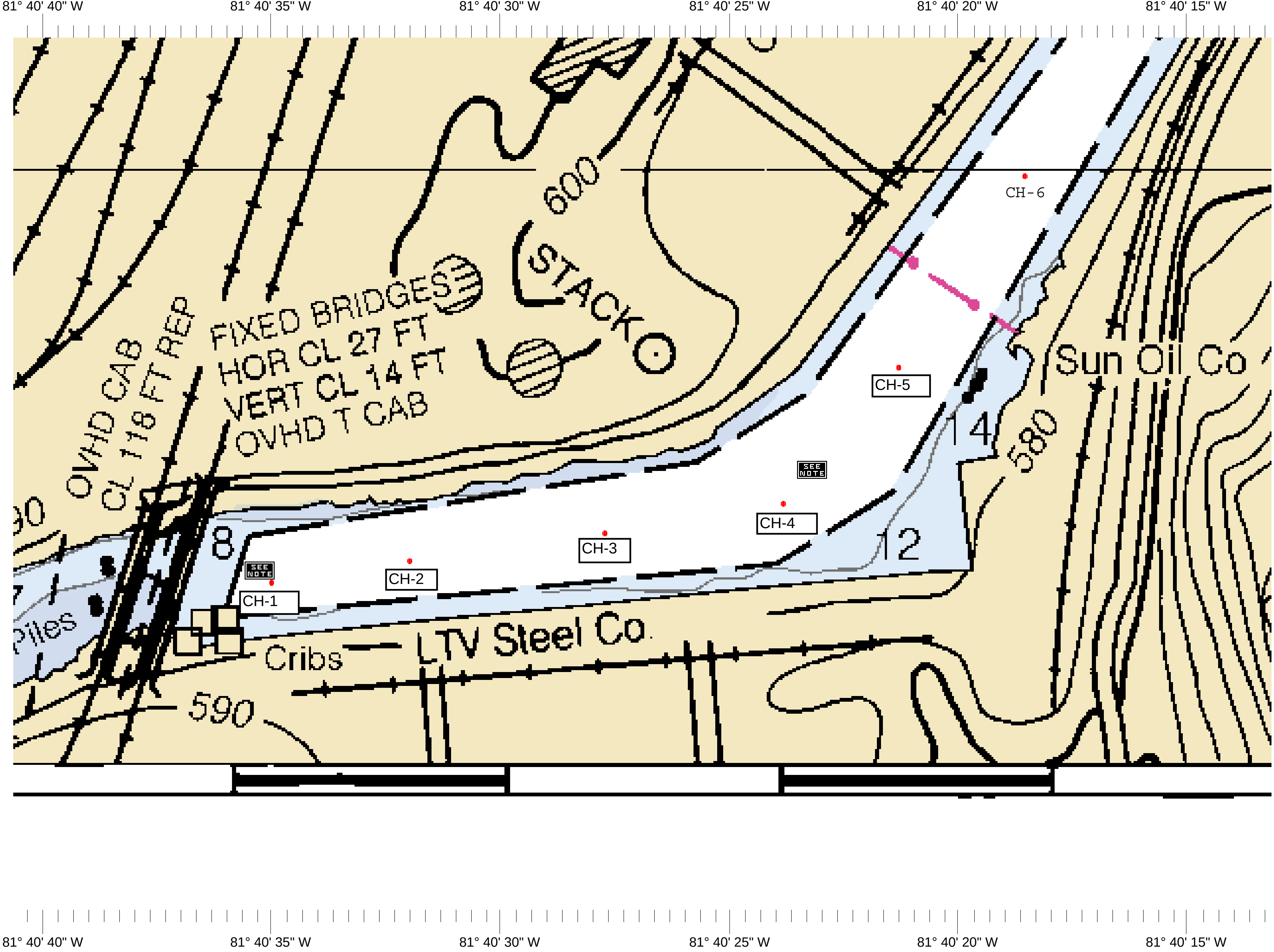


Figure 3.5 Cleveland Harbor Cuyahoga River Sampling Sites CH1-CH6

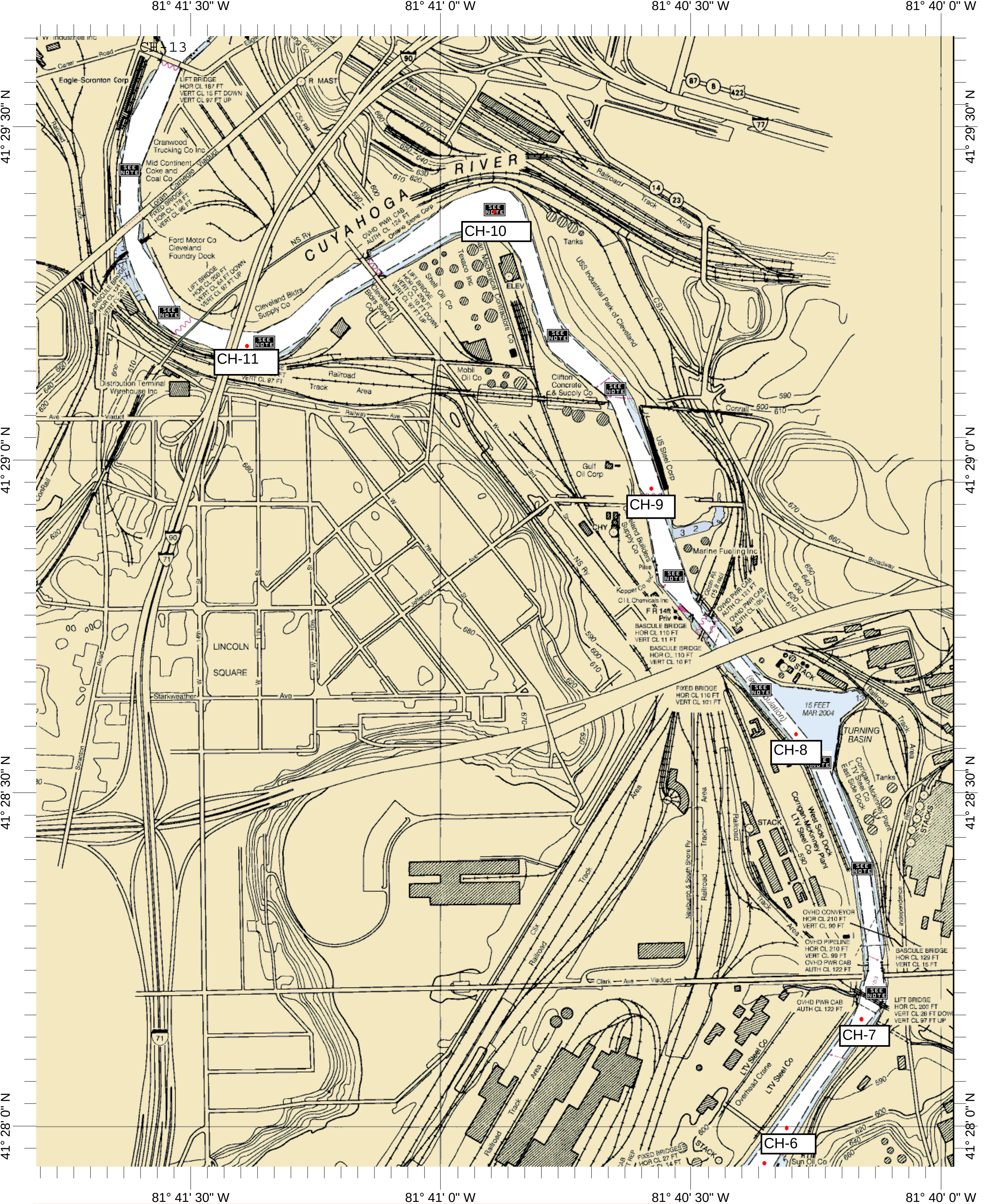


Figure 3.6 Cleveland Harbor Cuyahoga River Sampling Sites CH6-CH11

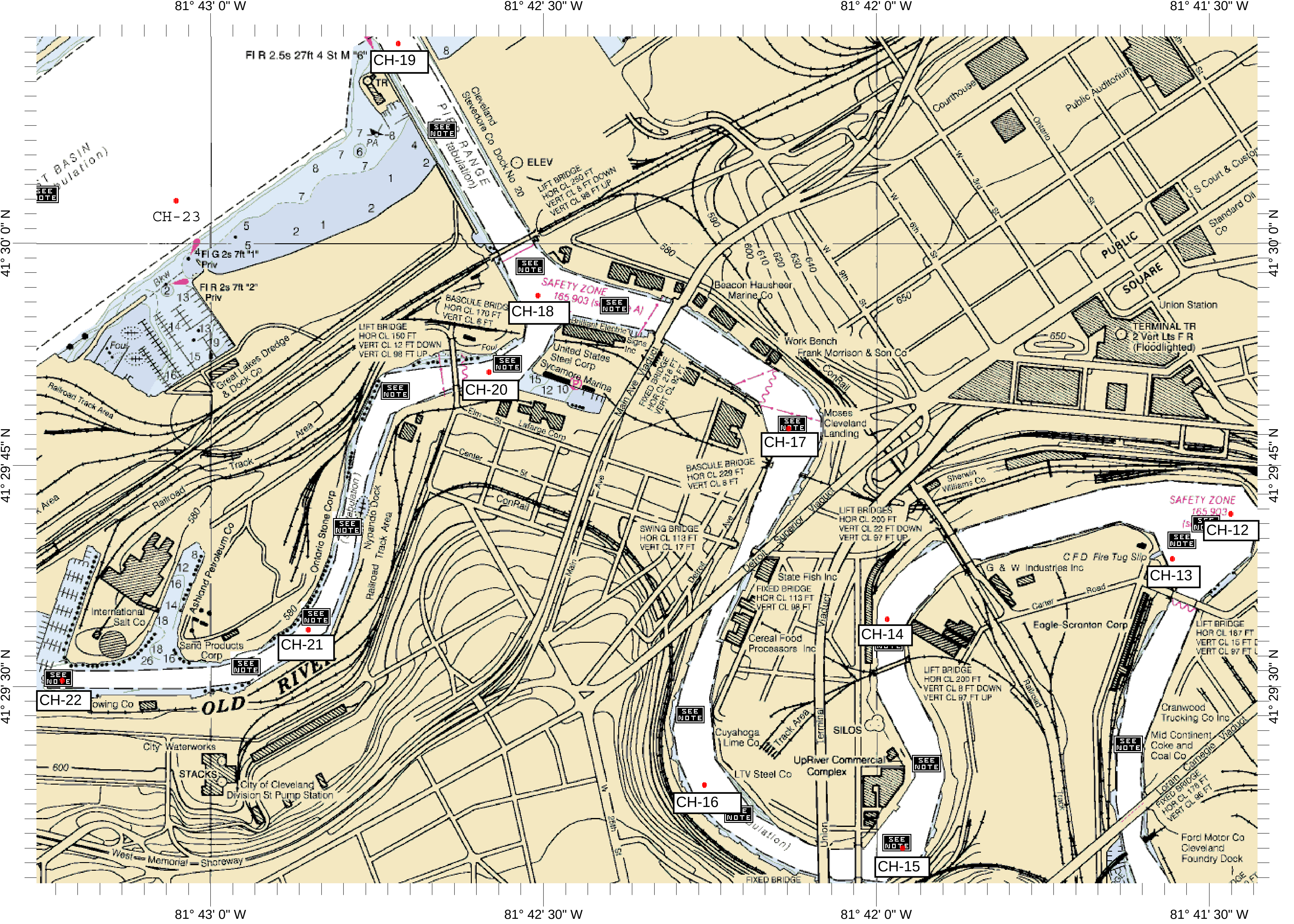


Figure 3.7 Cleveland Harbor Cuyahoga River Sampling Sites CH12-CH23

® MAPTECH, INC.

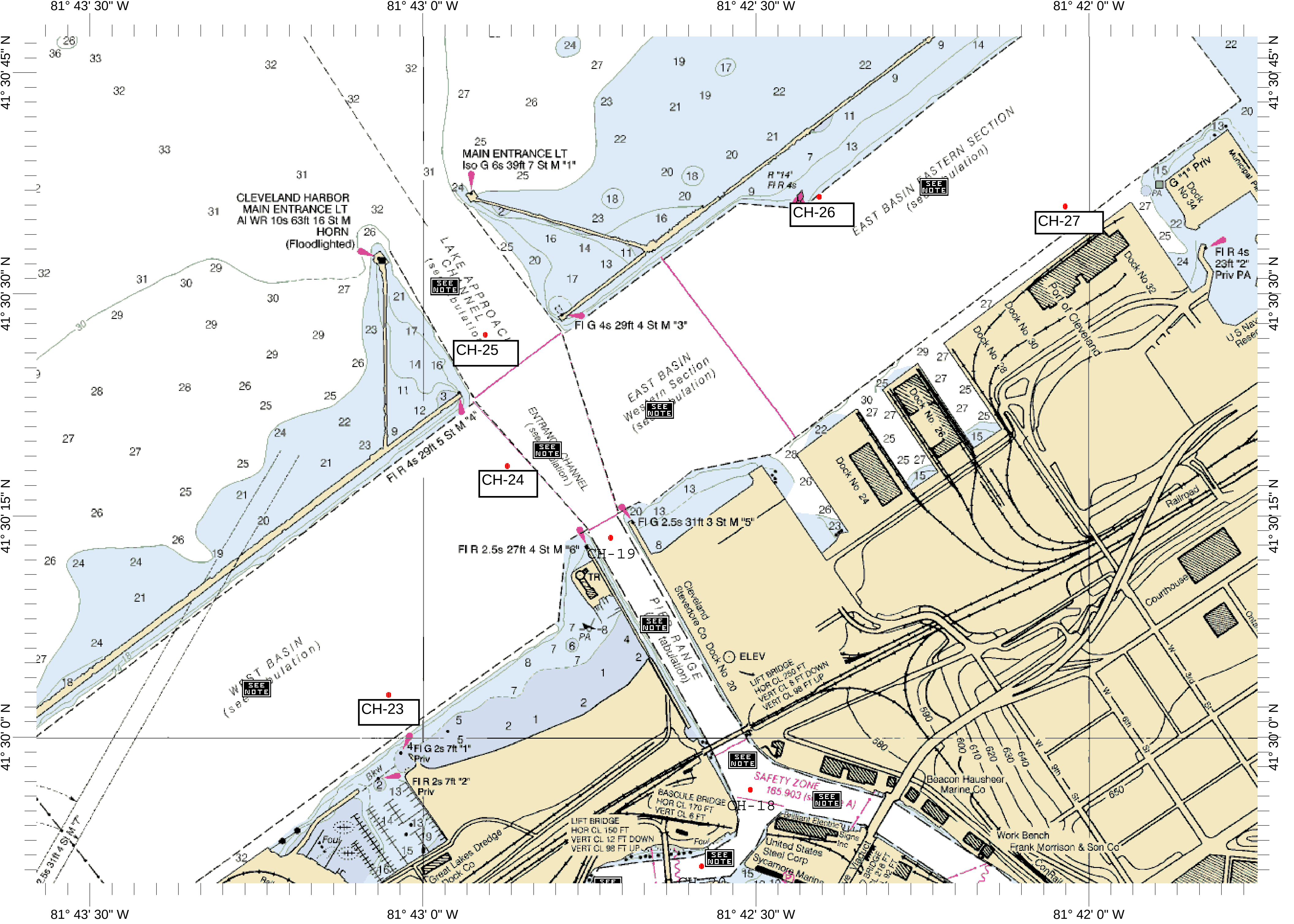


Figure 3.8 Cleveland Harbor Sampling Sites CH23-CH27

® MAPTECH, INC.

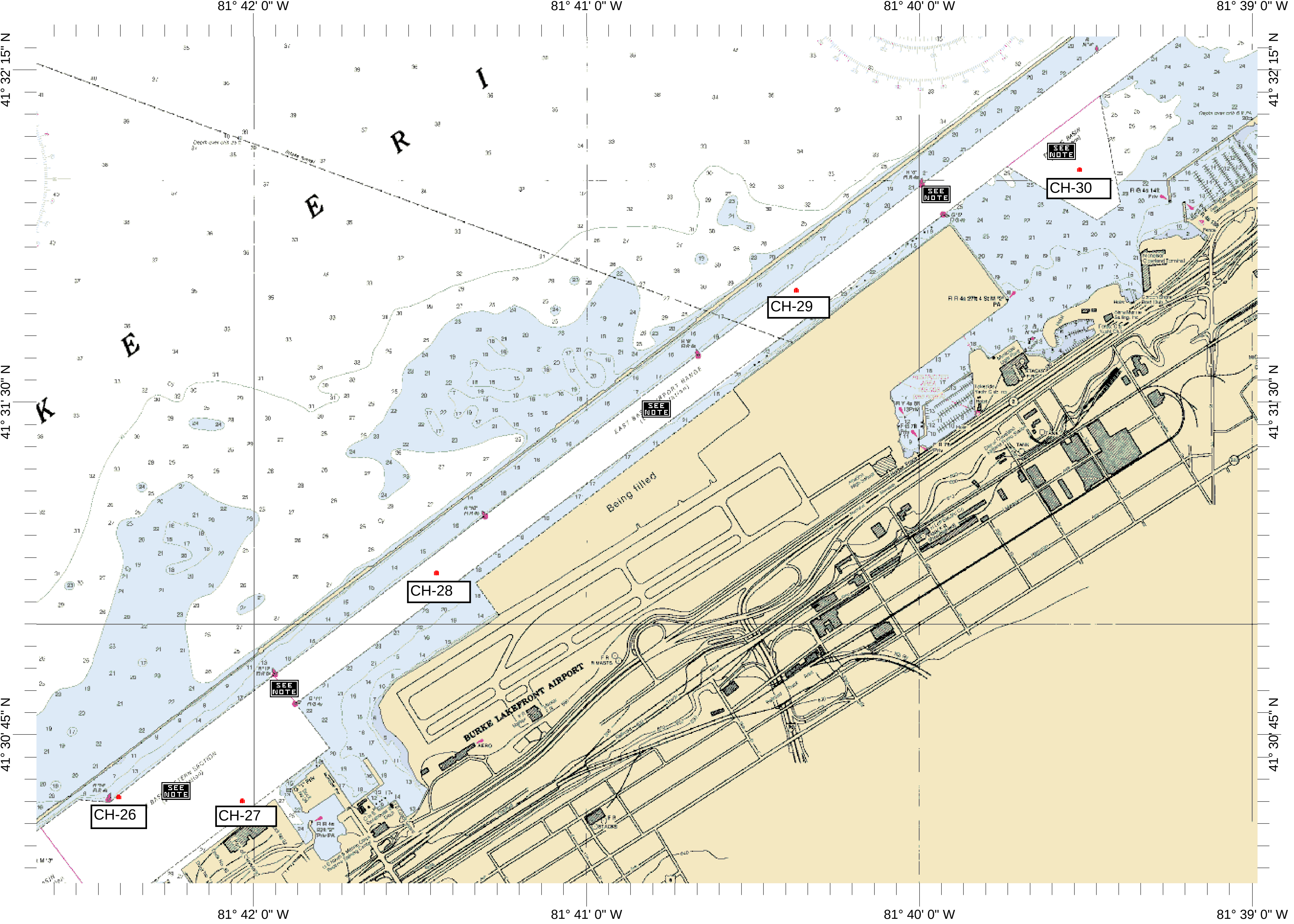


Figure 3.9 Cleveland Harbor Sampling Sites CH26-CH 30

® MAPTECH, INC.

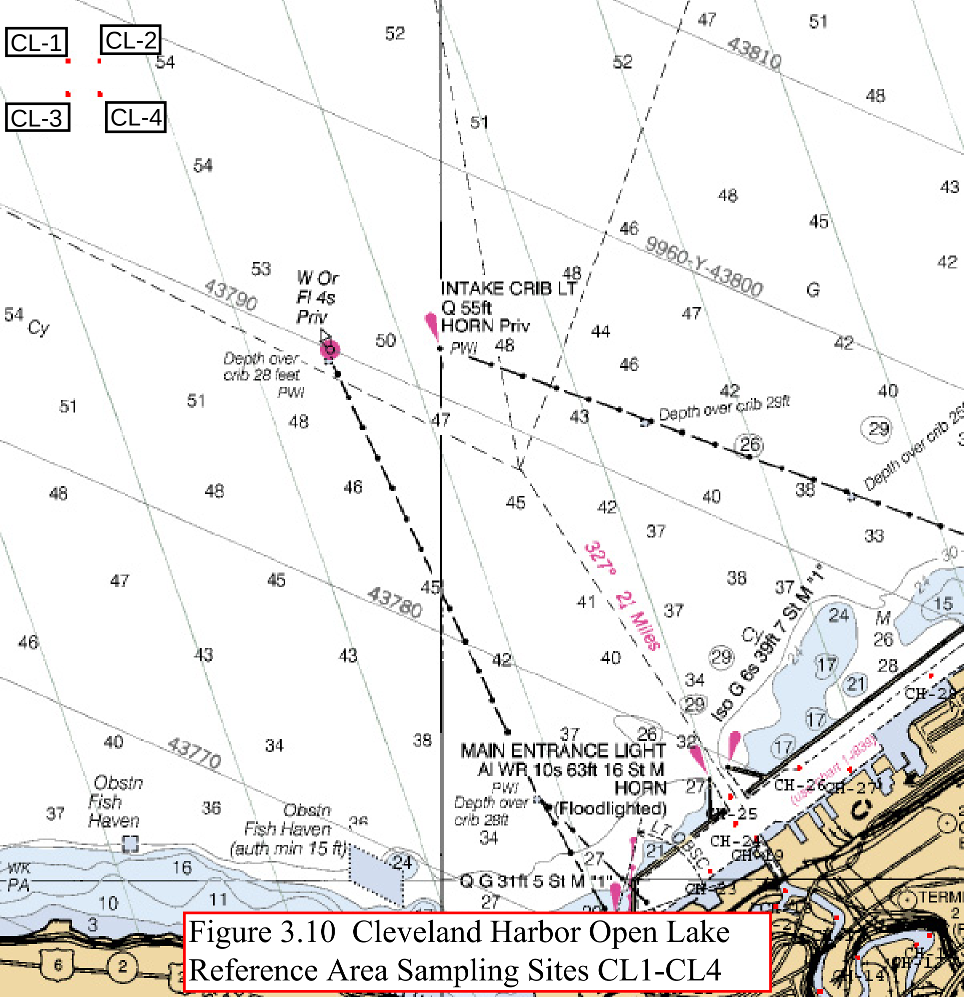


Figure 3.10 Cleveland Harbor Open Lake Reference Area Sampling Sites CL1-CL4

APPENDIX G

ECONOMIC EVALUATION

APPENDIX G

Part I

CLEVELAND HARBOR ECONOMIC VIABILITY ANALYSIS

Part II

CLEVELAND HARBOR DMMP ECONOMIC EVALUATION OF ALTERNATIVE PLANS

Part III

CLEVELAND HARBOR DMMP ECONOMIC EVALUATION SENSITIVITY ANALYSIS

APPENDIX G
Part I

CLEVELAND HARBOR
ECONOMIC VIABILITY ANALYSIS

INTRODUCTION

The Cleveland Harbor Dredge Material Management Plan (DMMP) looks at developing various Maintenance Plans that will allow dredging of the Harbor to continue for the next 20 years. These plans identify the amount of channel sediments that need to be dredged over the 20 year time period 2009-2028, identifies how the dredged sediment will be disposed of, and examines remaining CDF capacities and the need for more disposal space.

In order to be able to rank these various plans, and whether maintenance of the Harbor should even be continued, an economic evaluation of the viability of the harbor is needed. This part of Appendix G (Part I) documents the economic evaluation of the harbors viability. Data in this economic evaluation is based upon a Cleveland Harbor operations and maintenance economic evaluation report performed in Fiscal Year 2008. This report used a 20 year evaluation period and a 4 7/8 percent annual interest rate. Data in that evaluation was updated to reflect the Fiscal Year 09 Federal Discount rate of 4 5/8 percent. This Appendix (Appendix G, Part 1), presents a summary of this updating process.

First a description of the benefits and costs used in the operations and maintenance analysis is needed. Benefits attributable to continued maintenance of the Harbor are vessel transportation cost increases avoided. Continued maintenance of the Harbor allows vessels to move commodities through the harbor at a specific transportation cost. Discontinued maintenance of the harbor would result in channels shoaling in, vessels needing more trips to move the same amount of tonnage, and thus increasing transportation costs. This increase in transportation cost avoided is a proxy for the value of continuing to maintain the harbor.

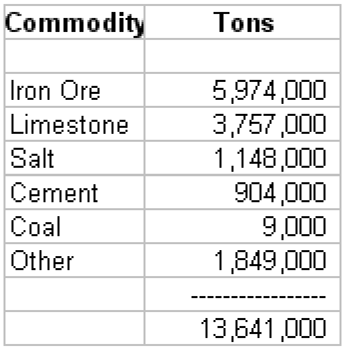
Current harbor dredging costs are calculated and subtracted from the total "Vessel Transportation Cost Increases Avoided Benefits" of the harbor. This results in net benefits associated with the Harbor. These net benefits are the basis for determining the amount of new investment the harbor could support. Net Benefits are used to identify the maximum amount of money that could be invested in the harbor and still have a benefit to cost ratio of one.

This maximum expenditure that results from a benefit to cost ratio of one can be compared to various harbor improvement costs to determine the economic viability of these harbor maintenance plans. If the costs of the various harbor maintenance plans are less than the maximum expenditure the harbor can support, the plan has a benefit to cost ratio greater than one and is economically justified. If the costs of the various harbor maintenance plans are greater than the maximum expenditure the harbor can support, the plan has a benefit to cost ratio less than one and is not economically justified.

HARBOR TONNAGES

Total tonnages handled at Cleveland Harbor in 2005 were 13,641,000. The main commodities handled were: iron ore (5,974,000) limestone (3,757,000), salt (1,148,000), cement (904,000) and coal (9,000). These commodities' accounted for 86 percent of the tonnage moving through the Harbor in 2005. These commodities were used to develop net benefits associated with continued maintenance of the harbor. The vessels actually used to move these commodities were identified, as well as the origin/destination routes that these vessels used. The 2005 vessel movements are considered representative of vessel traffic patterns and tonnages that will take place at Cleveland Harbor over the 20 year period 2009-2028. A summary of 2005 tonnages, by commodity, is provided in Table 1.

Table 1. - Cleveland Harbor Tonnages- 2005



Commodity	Tons
Iron Ore	5,974,000
Limestone	3,757,000
Salt	1,148,000
Cement	904,000
Coal	9,000
Other	1,849,000

	13,641,000

VESSEL TRANSPORTATION COSTS BY CHANNEL DEPTH

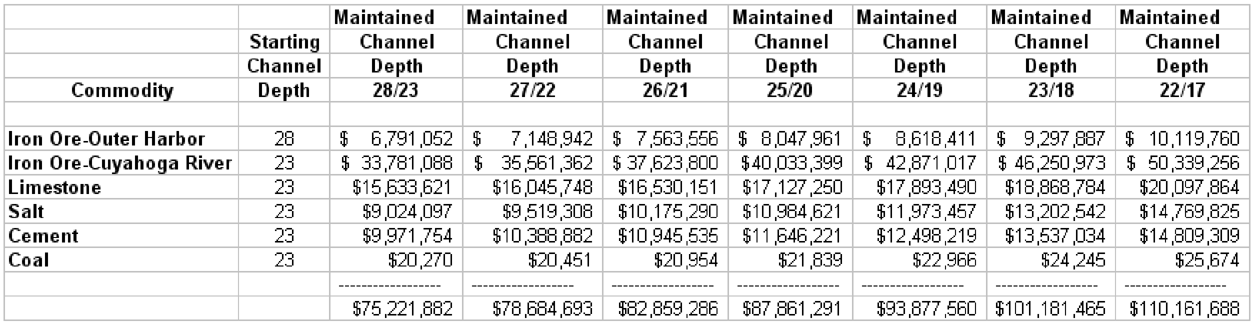
There were over 2,200 commercial vessel movements (inbound and outbound) in 2005. U.S. vessels accounted for about 66 percent of these movements and foreign vessels the remaining 34 percent. Approximately 55 percent of the inbound vessel movements drafted 23 feet of greater. This level of vessel activity and tonnage is expected to continue over the DMMP's project evaluation period 2009-2028.

The vessels actually used to move these 5 key commodities (iron ore, limestone, salt cement, and coal) were identified, as well as the origin/destination routes that these vessels used. These vessel movements and corresponding tonnages were used to develop vessel transportation costs associated with dredging Cleveland Harbor to various depths

A computer model developed by Buffalo District calculated increases in vessel transportation costs for each vessel movement given reductions in channel depth. The analysis is done in one foot increments for a maximum decrease in channel depth of 6 feet. Thus the analysis evaluated vessel transportation costs associated with existing authorized maintained depths of 28/23 feet in the Outer Harbor and Cuyahoga/Old River, as well as channels with up to 6 feet less of water column in one foot increments.

Shoaling of channels requires shippers to load their vessels with fewer commodities or use smaller ships thereby increasing transportation costs for movement of that commodity. Based on October 2007 dollars, transportation cost increases associated with reductions in channel depth from one to six feet were calculated for each of the 5 commodities. Annual transportation costs, by commodity, by channel depth are provided in Table 2.

Table 2. Cleveland Harbor- Vessel Transportation Costs, By Commodity, By Channel Depth



Commodity	Starting Channel Depth	Maintained Channel Depth 28/23	Maintained Channel Depth 27/22	Maintained Channel Depth 26/21	Maintained Channel Depth 25/20	Maintained Channel Depth 24/19	Maintained Channel Depth 23/18	Maintained Channel Depth 22/17
Iron Ore-Outer Harbor	28	$ 6,791,052	$ 7,148,942	$ 7,563,556	$ 8,047,961	$ 8,618,411	$ 9,297,887	$ 10,119,760
Iron Ore-Cuyahoga River	23	$ 33,781,088	$ 35,561,362	$ 37,623,800	$40,033,399	$ 42,871,017	$ 46,250,973	$ 50,339,256
Limestone	23	$15,633,621	$16,045,748	$16,530,151	$17,127,250	$17,893,490	$18,868,784	$20,097,864
Salt	23	$9,024,097	$9,519,308	$10,175,290	$10,984,621	$11,973,457	$13,202,542	$14,769,825
Cement	23	$9,971,754	$10,388,882	$10,945,535	$11,646,221	$12,498,219	$13,537,034	$14,809,309
Coal	23	$20,270	$20,451	$20,954	$21,839	$22,966	$24,245	$25,674
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		$75,221,882	$78,684,693	$82,859,286	$87,861,291	$93,877,560	$101,181,465	$110,161,688

Vessel transportation costs ranged from $75,221,882 for providing channels with 28/23 feet of water column, to $110,161,688 for providing channels with 22/17 feet of water column.

AVERAGE ANNUAL HARBOR BENEFITS

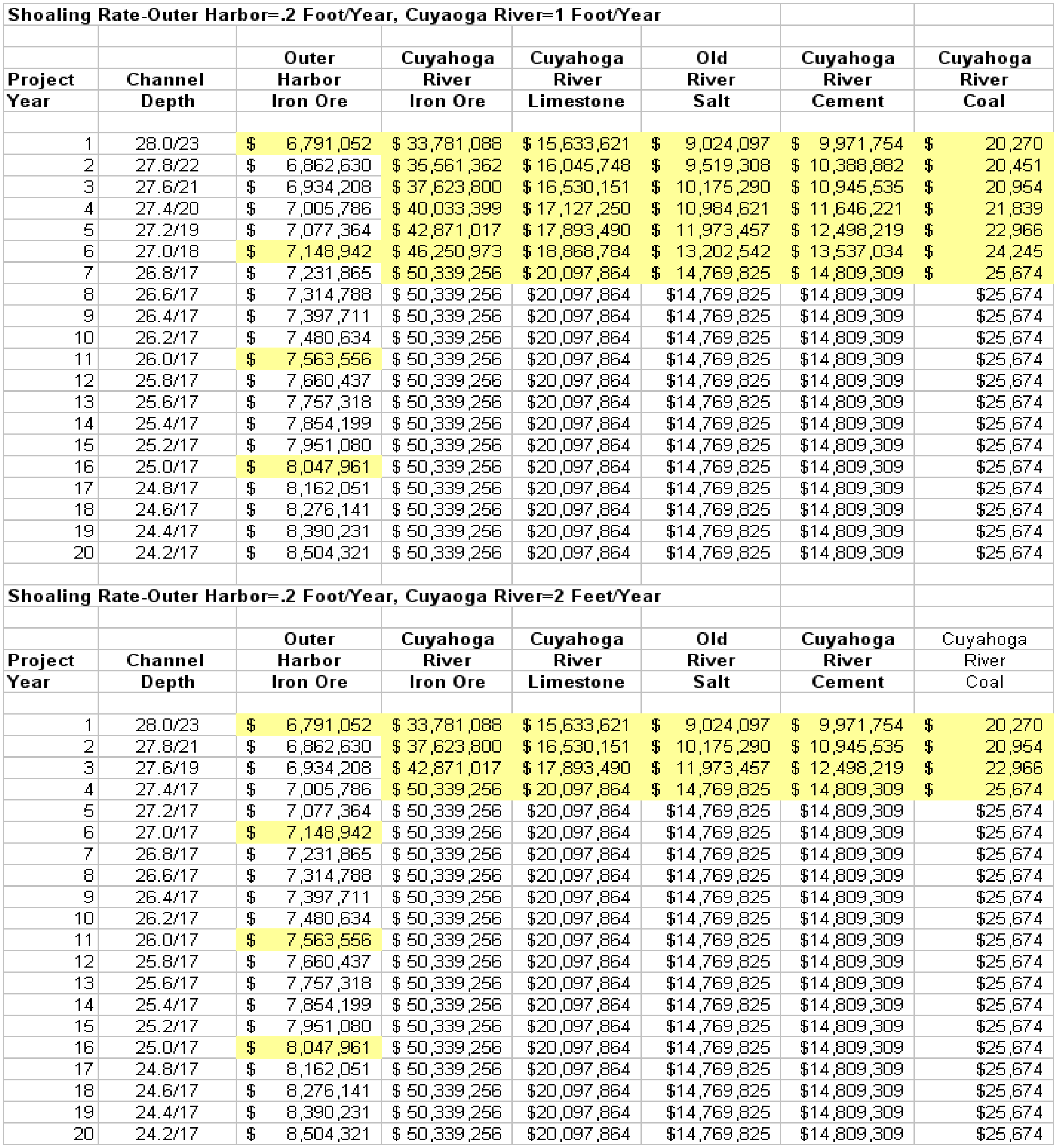
Benefits for this evaluation are the transportation cost increases avoided, by continuing to maintain the channels at the harbor. The difference in vessel transportation costs associated with maintaining current harbor depths (with Project Condition) and vessel transportation costs associated with discontinuing harbor dredging (without Project Condition), over a 20 year period, are the benefits associated with continuing to maintain the harbor

With Project Condition Average Annual Vessel Transportation Costs Table 2 provides the annual transportation costs associated with various maintained channel depths. The average annual transportation costs associated with continued maintenance of the harbors authorized 28/23 foot channels is presented in the column labeled “Maintained Channel Depth 28/23”. These average annual transportation costs come to $75,221,882. These are With Project Condition average annual vessel transportation costs.

Without Project Condition Average Annual Vessel Transportation Costs If dredging at Cleveland Harbor was to cease, due to lack of a suitable dredged material management plan, the channels would gradually fill in, and additional transportation costs would be incurred as estimated in Table 2.

Transportation costs associated with not maintaining the harbor is the transportation cost time stream that develops due to discontinued dredging, and the harbors annual shoaling rate. Shoaling rates at Cleveland harbor vary between the Outer Harbor (.2 of a foot per year) and the Cuyahoga/Old River (1-3 feet per year). The evaluation looked at two different shoaling rates on the river: one foot per year and 2 feet per year. Channels were allowed to shoal up 6 feet and then remain at that depth for the remainder of the 20 year evaluation period. The river channels equilibrium channel depth was assumed to be 17 feet. Transportation cost time streams were developed for a 20 year evaluation period based on these shoaling rates and the annual transportation costs by maintained channel depth provided in Table 2. Table 3 provides a summary of these transportation cost time streams, under the two shoaling rate scenarios.

Table 3. Cleveland Harbor WOP Condition Transportation Cost Time Streams



Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=1 Foot/Year

Project Year	Channel Depth	Outer Harbor Iron Ore	Cuyahoga River Iron Ore	Cuyahoga River Limestone	Old River Salt	Cuyahoga River Cement	Cuyahoga River Coal
1	28.0/23	$ 6,791,052	$ 33,781,088	$ 15,633,621	$ 9,024,097	$ 9,971,754	$ 20,270
2	27.8/22	$ 6,862,630	$ 35,561,362	$ 16,045,748	$ 9,519,308	$ 10,388,882	$ 20,451
3	27.6/21	$ 6,934,208	$ 37,623,800	$ 16,530,151	$ 10,175,290	$ 10,945,535	$ 20,954
4	27.4/20	$ 7,005,786	$ 40,033,399	$ 17,127,250	$ 10,984,621	$ 11,646,221	$ 21,839
5	27.2/19	$ 7,077,364	$ 42,871,017	$ 17,893,490	$ 11,973,457	$ 12,498,219	$ 22,966
6	27.0/18	$ 7,148,942	$ 46,250,973	$ 18,868,784	$ 13,202,542	$ 13,537,034	$ 24,245
7	26.8/17	$ 7,231,865	$ 50,339,256	$ 20,097,864	$ 14,769,825	$ 14,809,309	$ 25,674
8	26.6/17	$ 7,314,788	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
9	26.4/17	$ 7,397,711	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
10	26.2/17	$ 7,480,634	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
11	26.0/17	$ 7,563,556	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
12	25.8/17	$ 7,660,437	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
13	25.6/17	$ 7,757,318	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
14	25.4/17	$ 7,854,199	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
15	25.2/17	$ 7,951,080	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
16	25.0/17	$ 8,047,961	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
17	24.8/17	$ 8,162,051	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
18	24.6/17	$ 8,276,141	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
19	24.4/17	$ 8,390,231	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
20	24.2/17	$ 8,504,321	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674

Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=2 Feet/Year

Project Year	Channel Depth	Outer Harbor Iron Ore	Cuyahoga River Iron Ore	Cuyahoga River Limestone	Old River Salt	Cuyahoga River Cement	Cuyahoga River Coal
1	28.0/23	$ 6,791,052	$ 33,781,088	$ 15,633,621	$ 9,024,097	$ 9,971,754	$ 20,270
2	27.8/21	$ 6,862,630	$ 37,623,800	$ 16,530,151	$ 10,175,290	$ 10,945,535	$ 20,954
3	27.6/19	$ 6,934,208	$ 42,871,017	$ 17,893,490	$ 11,973,457	$ 12,498,219	$ 22,966
4	27.4/17	$ 7,005,786	$ 50,339,256	$ 20,097,864	$ 14,769,825	$ 14,809,309	$ 25,674
5	27.2/17	$ 7,077,364	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
6	27.0/17	$ 7,148,942	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
7	26.8/17	$ 7,231,865	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
8	26.6/17	$ 7,314,788	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
9	26.4/17	$ 7,397,711	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
10	26.2/17	$ 7,480,634	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
11	26.0/17	$ 7,563,556	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
12	25.8/17	$ 7,660,437	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
13	25.6/17	$ 7,757,318	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
14	25.4/17	$ 7,854,199	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
15	25.2/17	$ 7,951,080	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
16	25.0/17	$ 8,047,961	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
17	24.8/17	$ 8,162,051	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
18	24.6/17	$ 8,276,141	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
19	24.4/17	$ 8,390,231	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
20	24.2/17	$ 8,504,321	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674

These time streams were converted to average annual values using a 20 year project life and a 4.625 percent annual interest rate. Actual calculation of Without Project Condition vessel transportation costs for the five key commodities are provided in Table 4. Iron ore vessel transportation costs were broken out into Outer harbor and Cuyahoga River based on tonnages that passed through these two areas. Iron ore tonnages destined for the Cuyahoga River represent about 83 percent of all iron ore tonnages handled at the Harbor. Thus 83 percent of total iron ore transportation costs were associated with the Cuyahoga River. This allowed different shoaling rates (outer Harbor-.2 foot per year versus Cuyahoga river at 1 to 2 feet per year) to be applied to the iron ore transportation cost time streams.

Average annual WOP condition vessel transportation costs are summarized in Table 5 by commodity. The total average annual vessel transportation costs associated with not maintaining the harbor over a 20 year evaluation period range from $98,718,600 to $102,373,200.

Average Annual Harbor Transportation Benefits Average annual Harbor transportation cost savings associated with continuing to maintain harbor channel depths is the difference in average annual transportation costs between the WOP condition and providing currently maintained depths of 28 feet ($75,221,882). Average annual harbor transportation cost savings associated with maintaining a 28/23 foot channel depth are between $23,496,600 and $27,151,200 (Table 6).

NET HARBOR BENEFITS

Average annual harbor dredging costs were subtracted from total harbor transportation benefits to arrive at net harbor benefits. Average annual harbor dredging costs were based on a varying cubic yard removal schedule as outlined in the Cleveland Harbor DMMP. A removal and placement cost per cubic yard of $5.25 was used. Also included in dredging costs was, Engineering and Design, Supervision and Administration and Management of Engineering and Design. These annual dredging costs were placed into a 20 year time stream and converted to average annual costs using a 4.625 percent annual interest rate. Average annual dredging costs came to $2,054,600. Average annual dredging costs reflect a 4.625 percent annual interest rate. The calculation of average annual dredging costs is provided in Table 7.

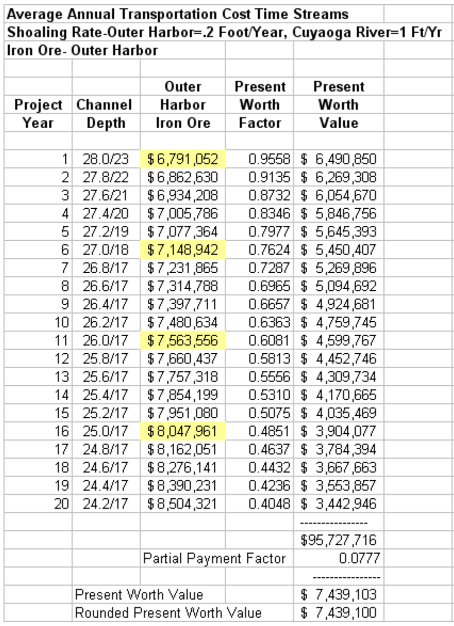
Average annual harbor dredging costs ($2,054,600) were subtracted from total average annual harbor benefits ($23,496,600 to $27,151,200). This resulted in average annual harbor net benefits. The Harbor has average annual net benefits of between $21,442,000 and $25,096,600. (Table 8).

SUPPORTABLE IMPROVEMENT PROJECTS

These net benefits can be converted to equivalent first costs, which represent the level of new CDF investment Cleveland Harbor can support. This process is presented in Table 8. Cleveland Harbor can support new CDF investments in the $276 million to $323 million range.

Table 4- Computation Of WOP Condition Average Annual Vessel Transportation Costs

A. WOP Condition- Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyahoga/Old River=1 Foot/Year

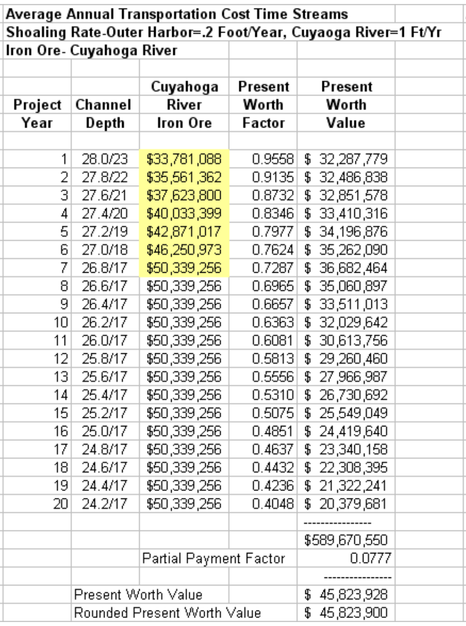


Average Annual Transportation Cost Time Streams
Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=1 Ft/Yr
Iron Ore- Outer Harbor

Project Year	Channel Depth	Outer Harbor Iron Ore	Present Worth Factor	Present Worth Value
1	28.0/23	$6,791,052	0.9558	$ 6,490,850
2	27.8/22	$6,862,630	0.9135	$ 6,269,308
3	27.6/21	$6,934,208	0.8732	$ 6,054,670
4	27.4/20	$7,005,786	0.8346	$ 5,846,756
5	27.2/19	$7,077,364	0.7977	$ 5,645,393
6	27.0/18	$7,148,942	0.7624	$ 5,450,407
7	26.8/17	$7,231,865	0.7287	$ 5,269,896
8	26.6/17	$7,314,788	0.6965	$ 5,094,692
9	26.4/17	$7,397,711	0.6657	$ 4,924,681
10	26.2/17	$7,480,634	0.6363	$ 4,759,745
11	26.0/17	$7,563,556	0.6081	$ 4,599,767
12	25.8/17	$7,660,437	0.5813	$ 4,452,746
13	25.6/17	$7,757,318	0.5556	$ 4,309,734
14	25.4/17	$7,854,199	0.5310	$ 4,170,665
15	25.2/17	$7,951,080	0.5075	$ 4,035,469
16	25.0/17	$8,047,961	0.4851	$ 3,904,077
17	24.8/17	$8,162,051	0.4637	$ 3,784,394
18	24.6/17	$8,276,141	0.4432	$ 3,667,663
19	24.4/17	$8,390,231	0.4236	$ 3,553,857
20	24.2/17	$8,504,321	0.4048	$ 3,442,946

				$95,727,716
		Partial Payment Factor		0.0777

	Present Worth Value			$ 7,439,103
	Rounded Present Worth Value			$ 7,439,100

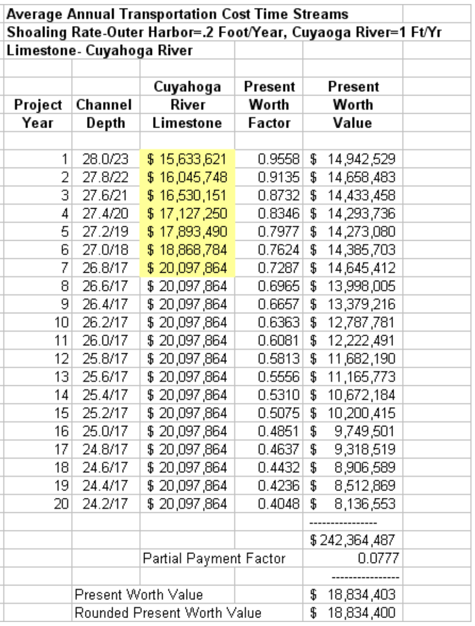


Average Annual Transportation Cost Time Streams
Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=1 Ft/Yr
Iron Ore- Cuyahoga River

Project Year	Channel Depth	Cuyahoga River Iron Ore	Present Worth Factor	Present Worth Value
1	28.0/23	$33,781,088	0.9558	$ 32,287,779
2	27.8/22	$35,561,362	0.9135	$ 32,486,838
3	27.6/21	$37,623,800	0.8732	$ 32,851,578
4	27.4/20	$40,033,399	0.8346	$ 33,410,316
5	27.2/19	$42,871,017	0.7977	$ 34,196,876
6	27.0/18	$46,250,973	0.7624	$ 35,262,090
7	26.8/17	$50,339,256	0.7287	$ 36,682,464
8	26.6/17	$50,339,256	0.6965	$ 35,060,897
9	26.4/17	$50,339,256	0.6657	$ 33,511,013
10	26.2/17	$50,339,256	0.6363	$ 32,029,642
11	26.0/17	$50,339,256	0.6081	$ 30,613,756
12	25.8/17	$50,339,256	0.5813	$ 29,260,460
13	25.6/17	$50,339,256	0.5556	$ 27,966,987
14	25.4/17	$50,339,256	0.5310	$ 26,730,692
15	25.2/17	$50,339,256	0.5075	$ 25,549,049
16	25.0/17	$50,339,256	0.4851	$ 24,419,640
17	24.8/17	$50,339,256	0.4637	$ 23,340,158
18	24.6/17	$50,339,256	0.4432	$ 22,308,395
19	24.4/17	$50,339,256	0.4236	$ 21,322,241
20	24.2/17	$50,339,256	0.4048	$ 20,379,681

				$589,670,550
		Partial Payment Factor		0.0777

	Present Worth Value			$ 45,823,928
	Rounded Present Worth Value			$ 45,823,900

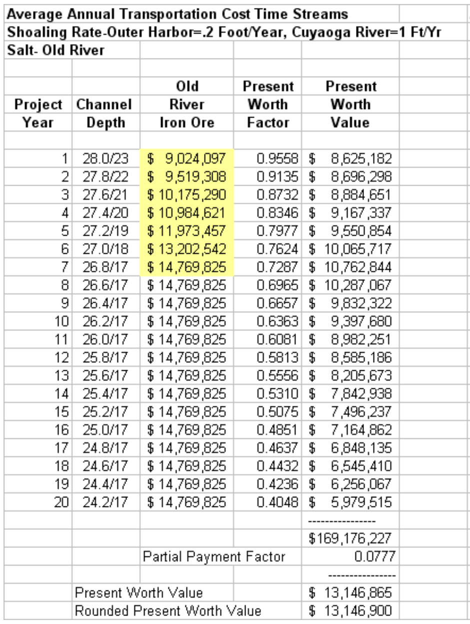


Average Annual Transportation Cost Time Streams
Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=1 Ft/Yr
Limestone- Cuyahoga River

Project Year	Channel Depth	Cuyahoga River Limestone	Present Worth Factor	Present Worth Value
1	28.0/23	$ 15,633,621	0.9558	$ 14,942,529
2	27.8/22	$ 16,045,748	0.9135	$ 14,658,483
3	27.6/21	$ 16,530,151	0.8732	$ 14,433,458
4	27.4/20	$ 17,127,250	0.8346	$ 14,293,736
5	27.2/19	$ 17,893,490	0.7977	$ 14,273,080
6	27.0/18	$ 18,868,784	0.7624	$ 14,385,703
7	26.8/17	$ 20,097,864	0.7287	$ 14,645,412
8	26.6/17	$ 20,097,864	0.6965	$ 13,998,005
9	26.4/17	$ 20,097,864	0.6657	$ 13,379,216
10	26.2/17	$ 20,097,864	0.6363	$ 12,787,781
11	26.0/17	$ 20,097,864	0.6081	$ 12,222,491
12	25.8/17	$ 20,097,864	0.5813	$ 11,682,190
13	25.6/17	$ 20,097,864	0.5556	$ 11,165,773
14	25.4/17	$ 20,097,864	0.5310	$ 10,672,184
15	25.2/17	$ 20,097,864	0.5075	$ 10,200,415
16	25.0/17	$ 20,097,864	0.4851	$ 9,749,501
17	24.8/17	$ 20,097,864	0.4637	$ 9,318,519
18	24.6/17	$ 20,097,864	0.4432	$ 8,906,589
19	24.4/17	$ 20,097,864	0.4236	$ 8,512,869
20	24.2/17	$ 20,097,864	0.4048	$ 8,136,553

				$ 242,364,487
		Partial Payment Factor		0.0777

	Present Worth Value			$ 18,834,403
	Rounded Present Worth Value			$ 18,834,400

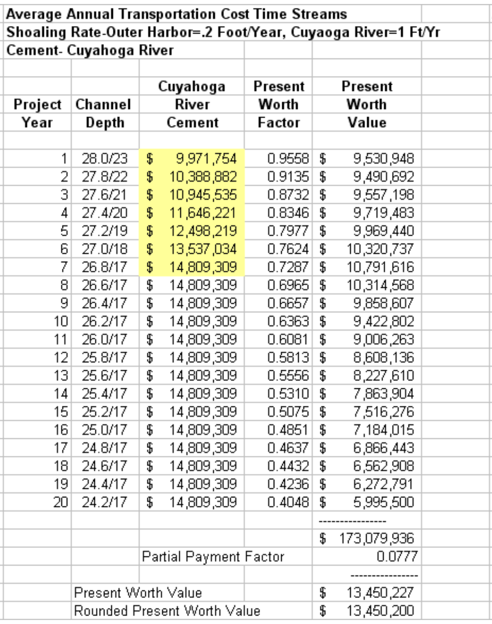


Average Annual Transportation Cost Time Streams
Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=1 Ft/Yr
Salt- Old River

Project Year	Channel Depth	Old River Iron Ore	Present Worth Factor	Present Worth Value
1	28.0/23	$ 9,024,097	0.9558	$ 8,625,182
2	27.8/22	$ 9,519,308	0.9135	$ 8,696,298
3	27.6/21	$ 10,175,290	0.8732	$ 8,884,651
4	27.4/20	$ 10,984,621	0.8346	$ 9,167,337
5	27.2/19	$ 11,973,457	0.7977	$ 9,550,854
6	27.0/18	$ 13,202,542	0.7624	$ 10,065,717
7	26.8/17	$ 14,769,825	0.7287	$ 10,762,844
8	26.6/17	$ 14,769,825	0.6965	$ 10,287,067
9	26.4/17	$ 14,769,825	0.6657	$ 9,832,322
10	26.2/17	$ 14,769,825	0.6363	$ 9,397,680
11	26.0/17	$ 14,769,825	0.6081	$ 8,982,251
12	25.8/17	$ 14,769,825	0.5813	$ 8,585,186
13	25.6/17	$ 14,769,825	0.5556	$ 8,205,673
14	25.4/17	$ 14,769,825	0.5310	$ 7,842,938
15	25.2/17	$ 14,769,825	0.5075	$ 7,496,237
16	25.0/17	$ 14,769,825	0.4851	$ 7,164,862
17	24.8/17	$ 14,769,825	0.4637	$ 6,848,135
18	24.6/17	$ 14,769,825	0.4432	$ 6,545,410
19	24.4/17	$ 14,769,825	0.4236	$ 6,256,067
20	24.2/17	$ 14,769,825	0.4048	$ 5,979,515

				$169,176,227
		Partial Payment Factor		0.0777

	Present Worth Value			$ 13,146,865
	Rounded Present Worth Value			$ 13,146,900

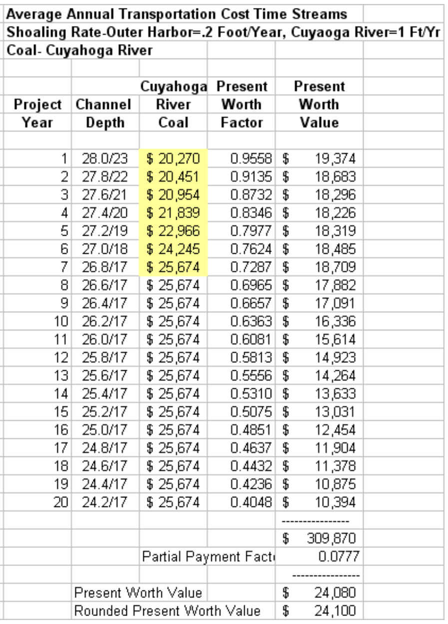


Average Annual Transportation Cost Time Streams
Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=1 Ft/Yr
Cement- Cuyahoga River

Project Year	Channel Depth	Cuyahoga River Cement	Present Worth Factor	Present Worth Value
1	28.0/23	$ 9,971,754	0.9558	$ 9,530,948
2	27.8/22	$ 10,388,882	0.9135	$ 9,490,692
3	27.6/21	$ 10,945,535	0.8732	$ 9,557,198
4	27.4/20	$ 11,646,221	0.8346	$ 9,719,483
5	27.2/19	$ 12,498,219	0.7977	$ 9,969,440
6	27.0/18	$ 13,537,034	0.7624	$ 10,320,737
7	26.8/17	$ 14,809,309	0.7287	$ 10,791,616
8	26.6/17	$ 14,809,309	0.6965	$ 10,314,568
9	26.4/17	$ 14,809,309	0.6657	$ 9,858,607
10	26.2/17	$ 14,809,309	0.6363	$ 9,422,802
11	26.0/17	$ 14,809,309	0.6081	$ 9,006,263
12	25.8/17	$ 14,809,309	0.5813	$ 8,608,136
13	25.6/17	$ 14,809,309	0.5556	$ 8,227,610
14	25.4/17	$ 14,809,309	0.5310	$ 7,863,904
15	25.2/17	$ 14,809,309	0.5075	$ 7,516,276
16	25.0/17	$ 14,809,309	0.4851	$ 7,184,015
17	24.8/17	$ 14,809,309	0.4637	$ 6,866,443
18	24.6/17	$ 14,809,309	0.4432	$ 6,562,908
19	24.4/17	$ 14,809,309	0.4236	$ 6,272,791
20	24.2/17	$ 14,809,309	0.4048	$ 5,995,500

				$ 173,079,936
		Partial Payment Factor		0.0777

	Present Worth Value			$ 13,450,227
	Rounded Present Worth Value			$ 13,450,200



Average Annual Transportation Cost Time Streams
Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=1 Ft/Yr
Coal- Cuyahoga River

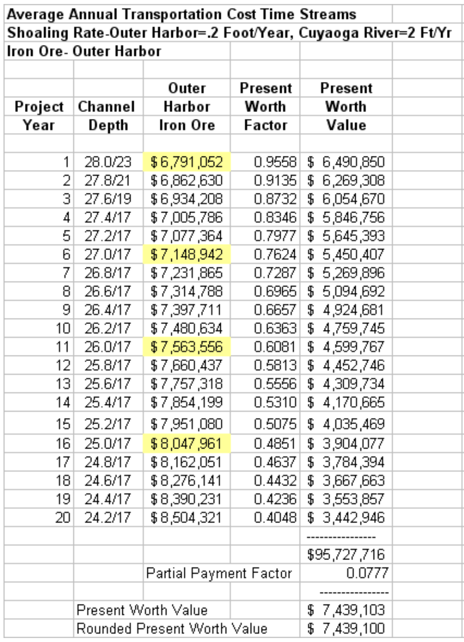
Project Year	Channel Depth	Cuyahoga River Coal	Present Worth Factor	Present Worth Value
1	28.0/23	$ 20,270	0.9558	$ 19,374
2	27.8/22	$ 20,451	0.9135	$ 18,683
3	27.6/21	$ 20,954	0.8732	$ 18,296
4	27.4/20	$ 21,839	0.8346	$ 18,226
5	27.2/19	$ 22,966	0.7977	$ 18,319
6	27.0/18	$ 24,245	0.7624	$ 18,485
7	26.8/17	$ 25,674	0.7287	$ 18,709
8	26.6/17	$ 25,674	0.6965	$ 17,882
9	26.4/17	$ 25,674	0.6657	$ 17,091
10	26.2/17	$ 25,674	0.6363	$ 16,336
11	26.0/17	$ 25,674	0.6081	$ 15,614
12	25.8/17	$ 25,674	0.5813	$ 14,923
13	25.6/17	$ 25,674	0.5556	$ 14,264
14	25.4/17	$ 25,674	0.5310	$ 13,633
15	25.2/17	$ 25,674	0.5075	$ 13,031
16	25.0/17	$ 25,674	0.4851	$ 12,454
17	24.8/17	$ 25,674	0.4637	$ 11,904
18	24.6/17	$ 25,674	0.4432	$ 11,378
19	24.4/17	$ 25,674	0.4236	$ 10,875
20	24.2/17	$ 25,674	0.4048	$ 10,394

				$ 309,870
		Partial Payment Fact		0.0777

	Present Worth Value			$ 24,080
	Rounded Present Worth Value			$ 24,100

Table 4- Computation Of WOP Condition Average Annual Vessel Transportation Costs

B. WOP Condition- Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyahoga/Old River=2 Feet/Year

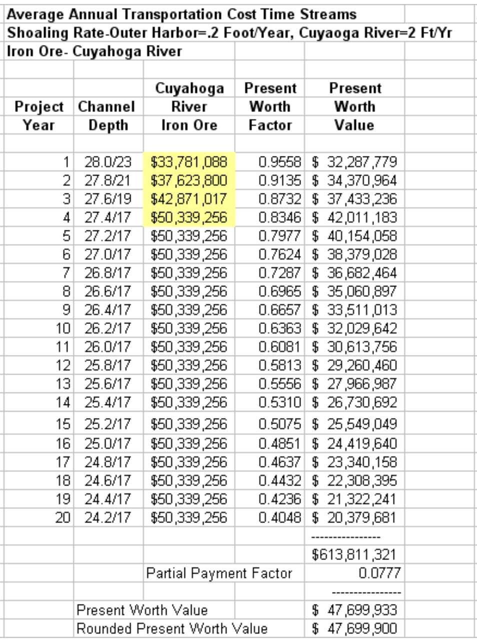


Average Annual Transportation Cost Time Streams
Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=2 Ft/Yr
Iron Ore- Outer Harbor

Project Year	Channel Depth	Outer Harbor Iron Ore	Present Worth Factor	Present Worth Value
1	28.0/23	$6,791,052	0.9558	$ 6,490,850
2	27.8/21	$6,862,630	0.9135	$ 6,269,308
3	27.6/19	$6,934,208	0.8732	$ 6,054,670
4	27.4/17	$7,005,786	0.8346	$ 5,846,756
5	27.2/17	$7,077,364	0.7977	$ 5,645,393
6	27.0/17	$7,148,942	0.7624	$ 5,450,407
7	26.8/17	$7,231,865	0.7287	$ 5,269,896
8	26.6/17	$7,314,788	0.6965	$ 5,094,692
9	26.4/17	$7,397,711	0.6657	$ 4,924,681
10	26.2/17	$7,480,634	0.6363	$ 4,759,745
11	26.0/17	$7,563,556	0.6081	$ 4,599,767
12	25.8/17	$7,660,437	0.5813	$ 4,452,746
13	25.6/17	$7,757,318	0.5556	$ 4,309,734
14	25.4/17	$7,854,199	0.5310	$ 4,170,665
15	25.2/17	$7,951,080	0.5075	$ 4,035,469
16	25.0/17	$8,047,961	0.4851	$ 3,904,077
17	24.8/17	$8,162,051	0.4637	$ 3,784,394
18	24.6/17	$8,276,141	0.4432	$ 3,667,663
19	24.4/17	$8,390,231	0.4236	$ 3,553,857
20	24.2/17	$8,504,321	0.4048	$ 3,442,946

				$95,727,716
		Partial Payment Factor		0.0777

	Present Worth Value			$ 7,439,103
	Rounded Present Worth Value			$ 7,439,100

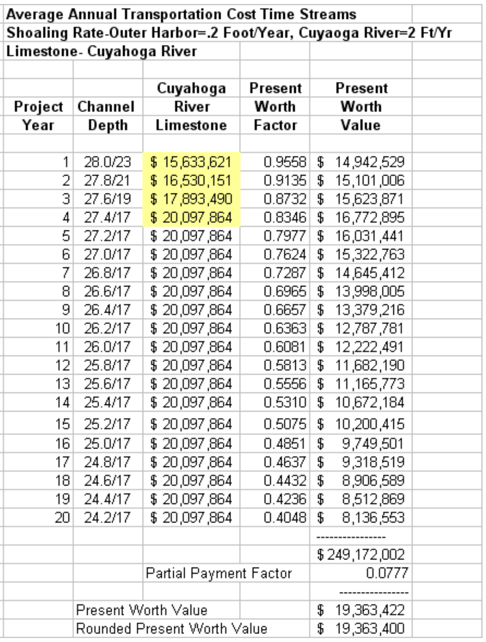


Average Annual Transportation Cost Time Streams
Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=2 Ft/Yr
Iron Ore- Cuyahoga River

Project Year	Channel Depth	Cuyahoga River Iron Ore	Present Worth Factor	Present Worth Value
1	28.0/23	$33,781,088	0.9558	$ 32,287,779
2	27.8/21	$37,623,800	0.9135	$ 34,370,964
3	27.6/19	$42,871,017	0.8732	$ 37,433,236
4	27.4/17	$50,339,256	0.8346	$ 42,011,183
5	27.2/17	$50,339,256	0.7977	$ 40,154,058
6	27.0/17	$50,339,256	0.7624	$ 38,379,028
7	26.8/17	$50,339,256	0.7287	$ 36,682,464
8	26.6/17	$50,339,256	0.6965	$ 35,060,897
9	26.4/17	$50,339,256	0.6657	$ 33,511,013
10	26.2/17	$50,339,256	0.6363	$ 32,029,642
11	26.0/17	$50,339,256	0.6081	$ 30,613,756
12	25.8/17	$50,339,256	0.5813	$ 29,260,460
13	25.6/17	$50,339,256	0.5556	$ 27,966,987
14	25.4/17	$50,339,256	0.5310	$ 26,730,692
15	25.2/17	$50,339,256	0.5075	$ 25,549,049
16	25.0/17	$50,339,256	0.4851	$ 24,419,640
17	24.8/17	$50,339,256	0.4637	$ 23,340,158
18	24.6/17	$50,339,256	0.4432	$ 22,308,395
19	24.4/17	$50,339,256	0.4236	$ 21,322,241
20	24.2/17	$50,339,256	0.4048	$ 20,379,681

				$613,811,321
		Partial Payment Factor		0.0777

	Present Worth Value			$ 47,699,933
	Rounded Present Worth Value			$ 47,699,900

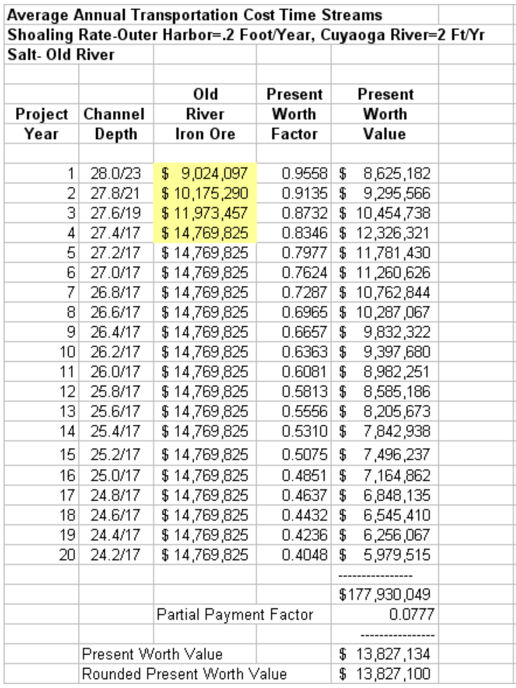


Average Annual Transportation Cost Time Streams
Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=2 Ft/Yr
Limestone- Cuyahoga River

Project Year	Channel Depth	Cuyahoga River Limestone	Present Worth Factor	Present Worth Value
1	28.0/23	$ 15,633,621	0.9558	$ 14,942,529
2	27.8/21	$ 16,530,151	0.9135	$ 15,101,006
3	27.6/19	$ 17,893,490	0.8732	$ 15,623,871
4	27.4/17	$ 20,097,864	0.8346	$ 16,772,895
5	27.2/17	$ 20,097,864	0.7977	$ 16,031,441
6	27.0/17	$ 20,097,864	0.7624	$ 15,322,763
7	26.8/17	$ 20,097,864	0.7287	$ 14,645,412
8	26.6/17	$ 20,097,864	0.6965	$ 13,998,005
9	26.4/17	$ 20,097,864	0.6657	$ 13,379,216
10	26.2/17	$ 20,097,864	0.6363	$ 12,787,781
11	26.0/17	$ 20,097,864	0.6081	$ 12,222,491
12	25.8/17	$ 20,097,864	0.5813	$ 11,682,190
13	25.6/17	$ 20,097,864	0.5556	$ 11,165,773
14	25.4/17	$ 20,097,864	0.5310	$ 10,672,184
15	25.2/17	$ 20,097,864	0.5075	$ 10,200,415
16	25.0/17	$ 20,097,864	0.4851	$ 9,749,501
17	24.8/17	$ 20,097,864	0.4637	$ 9,318,519
18	24.6/17	$ 20,097,864	0.4432	$ 8,906,589
19	24.4/17	$ 20,097,864	0.4236	$ 8,512,869
20	24.2/17	$ 20,097,864	0.4048	$ 8,136,553

				$ 249,172,002
		Partial Payment Factor		0.0777

	Present Worth Value			$ 19,363,422
	Rounded Present Worth Value			$ 19,363,400

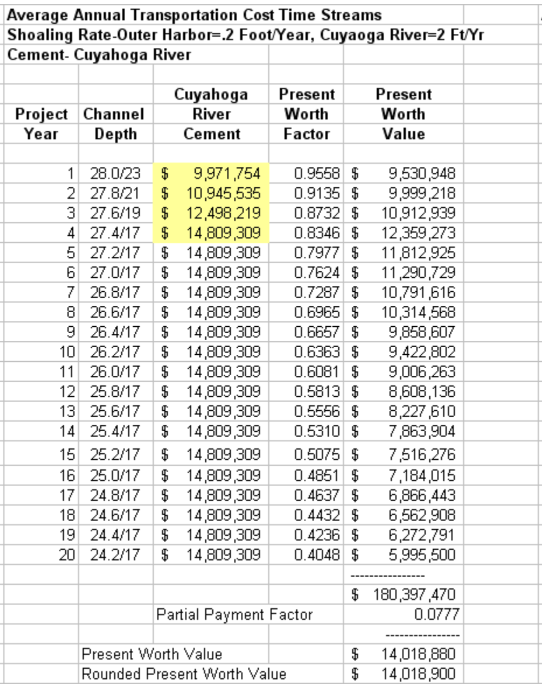


Average Annual Transportation Cost Time Streams
Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=2 Ft/Yr
Salt- Old River

Project Year	Channel Depth	Old River Iron Ore	Present Worth Factor	Present Worth Value
1	28.0/23	$ 9,024,097	0.9558	$ 8,625,182
2	27.8/21	$ 10,175,290	0.9135	$ 9,295,566
3	27.6/19	$ 11,973,457	0.8732	$ 10,454,738
4	27.4/17	$ 14,769,825	0.8346	$ 12,326,321
5	27.2/17	$ 14,769,825	0.7977	$ 11,781,430
6	27.0/17	$ 14,769,825	0.7624	$ 11,260,626
7	26.8/17	$ 14,769,825	0.7287	$ 10,762,844
8	26.6/17	$ 14,769,825	0.6965	$ 10,287,067
9	26.4/17	$ 14,769,825	0.6657	$ 9,832,322
10	26.2/17	$ 14,769,825	0.6363	$ 9,397,680
11	26.0/17	$ 14,769,825	0.6081	$ 8,982,251
12	25.8/17	$ 14,769,825	0.5813	$ 8,585,186
13	25.6/17	$ 14,769,825	0.5556	$ 8,205,673
14	25.4/17	$ 14,769,825	0.5310	$ 7,842,938
15	25.2/17	$ 14,769,825	0.5075	$ 7,496,237
16	25.0/17	$ 14,769,825	0.4851	$ 7,164,862
17	24.8/17	$ 14,769,825	0.4637	$ 6,848,135
18	24.6/17	$ 14,769,825	0.4432	$ 6,545,410
19	24.4/17	$ 14,769,825	0.4236	$ 6,256,067
20	24.2/17	$ 14,769,825	0.4048	$ 5,979,515

				$177,930,049
		Partial Payment Factor		0.0777

	Present Worth Value			$ 13,827,134
	Rounded Present Worth Value			$ 13,827,100

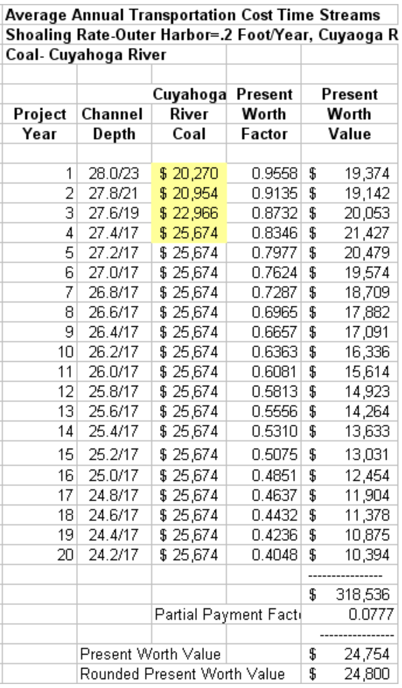


Average Annual Transportation Cost Time Streams
Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=2 Ft/Yr
Cement- Cuyahoga River

Project Year	Channel Depth	Cuyahoga River Cement	Present Worth Factor	Present Worth Value
1	28.0/23	$ 9,971,754	0.9558	$ 9,530,948
2	27.8/21	$ 10,945,535	0.9135	$ 9,999,218
3	27.6/19	$ 12,498,219	0.8732	$ 10,912,939
4	27.4/17	$ 14,809,309	0.8346	$ 12,359,273
5	27.2/17	$ 14,809,309	0.7977	$ 11,812,925
6	27.0/17	$ 14,809,309	0.7624	$ 11,290,729
7	26.8/17	$ 14,809,309	0.7287	$ 10,791,616
8	26.6/17	$ 14,809,309	0.6965	$ 10,314,568
9	26.4/17	$ 14,809,309	0.6657	$ 9,858,607
10	26.2/17	$ 14,809,309	0.6363	$ 9,422,802
11	26.0/17	$ 14,809,309	0.6081	$ 9,006,263
12	25.8/17	$ 14,809,309	0.5813	$ 8,608,136
13	25.6/17	$ 14,809,309	0.5556	$ 8,227,610
14	25.4/17	$ 14,809,309	0.5310	$ 7,863,904
15	25.2/17	$ 14,809,309	0.5075	$ 7,516,276
16	25.0/17	$ 14,809,309	0.4851	$ 7,184,015
17	24.8/17	$ 14,809,309	0.4637	$ 6,866,443
18	24.6/17	$ 14,809,309	0.4432	$ 6,562,908
19	24.4/17	$ 14,809,309	0.4236	$ 6,272,791
20	24.2/17	$ 14,809,309	0.4048	$ 5,995,500

				$ 180,397,470
		Partial Payment Factor		0.0777

	Present Worth Value			$ 14,018,880
	Rounded Present Worth Value			$ 14,018,900



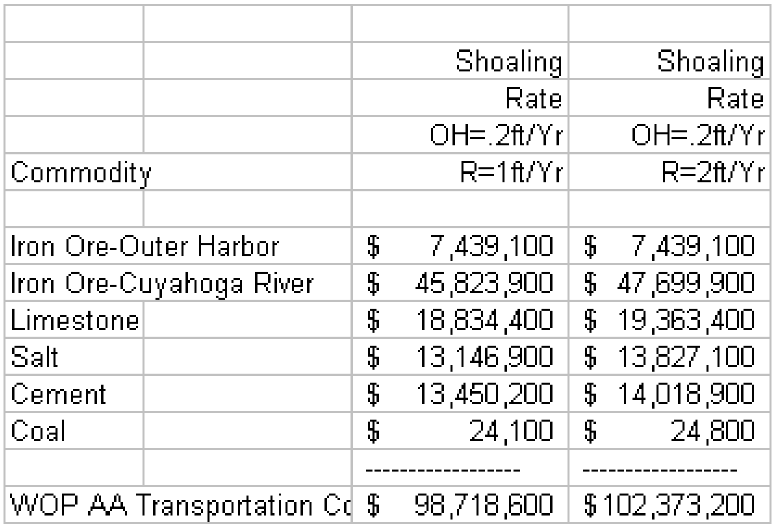
Average Annual Transportation Cost Time Streams
Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga R
Coal- Cuyahoga River

Project Year	Channel Depth	Cuyahoga River Coal	Present Worth Factor	Present Worth Value
1	28.0/23	$ 20,270	0.9558	$ 19,374
2	27.8/21	$ 20,954	0.9135	$ 19,142
3	27.6/19	$ 22,966	0.8732	$ 20,053
4	27.4/17	$ 25,674	0.8346	$ 21,427
5	27.2/17	$ 25,674	0.7977	$ 20,479
6	27.0/17	$ 25,674	0.7624	$ 19,574
7	26.8/17	$ 25,674	0.7287	$ 18,709
8	26.6/17	$ 25,674	0.6965	$ 17,882
9	26.4/17	$ 25,674	0.6657	$ 17,091
10	26.2/17	$ 25,674	0.6363	$ 16,336
11	26.0/17	$ 25,674	0.6081	$ 15,614
12	25.8/17	$ 25,674	0.5813	$ 14,923
13	25.6/17	$ 25,674	0.5556	$ 14,264
14	25.4/17	$ 25,674	0.5310	$ 13,633
15	25.2/17	$ 25,674	0.5075	$ 13,031
16	25.0/17	$ 25,674	0.4851	$ 12,454
17	24.8/17	$ 25,674	0.4637	$ 11,904
18	24.6/17	$ 25,674	0.4432	$ 11,378
19	24.4/17	$ 25,674	0.4236	$ 10,875
20	24.2/17	$ 25,674	0.4048	$ 10,394

				$ 318,536
		Partial Payment Fact		0.0777

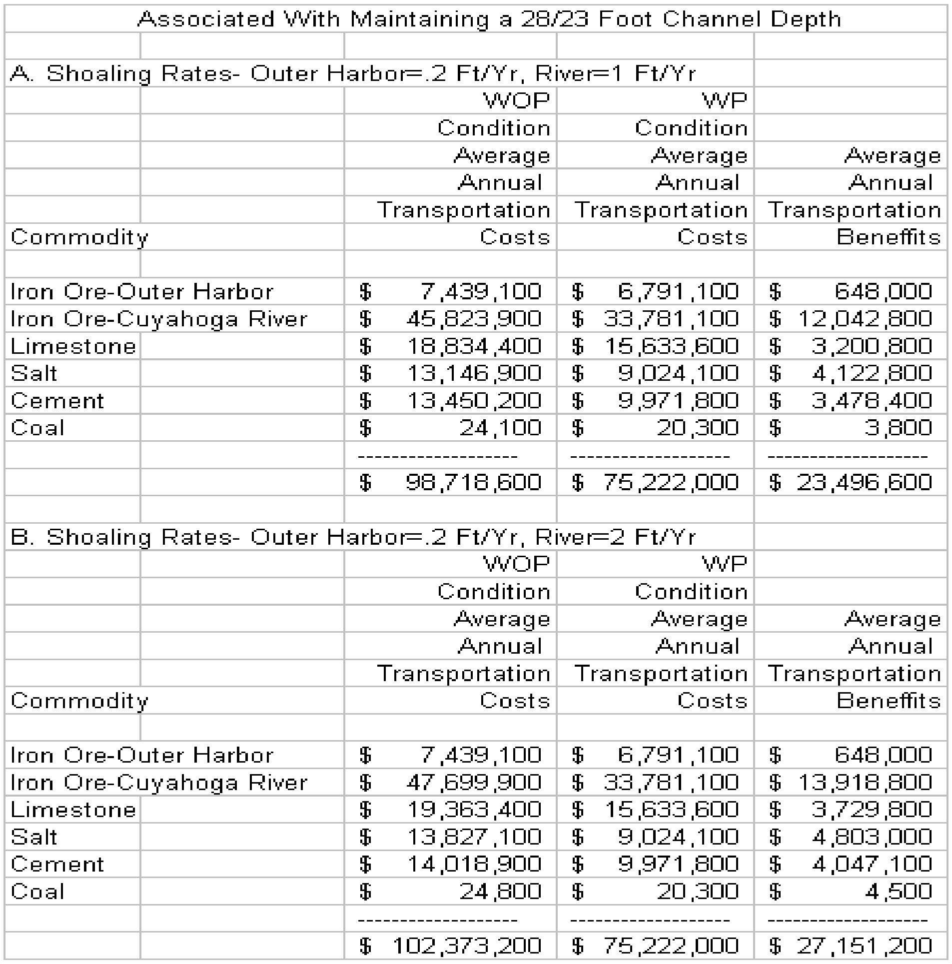
	Present Worth Value			$ 24,754
	Rounded Present Worth Value			$ 24,800

Table 5. Cleveland Harbor WOP Condition Average Annual Vessel Transportation Costs



Commodity	Shoaling Rate OH=.2ft/Yr R=1ft/Yr	Shoaling Rate OH=.2ft/Yr R=2ft/Yr
Iron Ore-Outer Harbor	$ 7,439,100	$ 7,439,100
Iron Ore-Cuyahoga River	$ 45,823,900	$ 47,699,900
Limestone	$ 18,834,400	$ 19,363,400
Salt	$ 13,146,900	$ 13,827,100
Cement	$ 13,450,200	$ 14,018,900
Coal	$ 24,100	$ 24,800
	------------------	------------------
WOP AA Transportation Cc	$ 98,718,600	$102,373,200

Table 6. Cleveland Harbor Average Annual Harbor Transportation Cost Savings Associated With Maintaining a 28/23 Foot Channel Depth



Associated With Maintaining a 28/23 Foot Channel Depth

A. Shoaling Rates- Outer Harbor=.2 Ft/Yr, River=1 Ft/Yr			
Commodity	WOP Condition Average Annual Transportation Costs	WP Condition Average Annual Transportation Costs	Average Annual Transportation Beneffits
Iron Ore-Outer Harbor	$ 7,439,100	$ 6,791,100	$ 648,000
Iron Ore-Cuyahoga River	$ 45,823,900	$ 33,781,100	$ 12,042,800
Limestone	$ 18,834,400	$ 15,633,600	$ 3,200,800
Salt	$ 13,146,900	$ 9,024,100	$ 4,122,800
Cement	$ 13,450,200	$ 9,971,800	$ 3,478,400
Coal	$ 24,100	$ 20,300	$ 3,800
	-------------------	-------------------	-------------------
	$ 98,718,600	$ 75,222,000	$ 23,496,600
B. Shoaling Rates- Outer Harbor=.2 Ft/Yr, River=2 Ft/Yr			
Commodity	WOP Condition Average Annual Transportation Costs	WP Condition Average Annual Transportation Costs	Average Annual Transportation Beneffits
Iron Ore-Outer Harbor	$ 7,439,100	$ 6,791,100	$ 648,000
Iron Ore-Cuyahoga River	$ 47,699,900	$ 33,781,100	$ 13,918,800
Limestone	$ 19,363,400	$ 15,633,600	$ 3,729,800
Salt	$ 13,827,100	$ 9,024,100	$ 4,803,000
Cement	$ 14,018,900	$ 9,971,800	$ 4,047,100
Coal	$ 24,800	$ 20,300	$ 4,500
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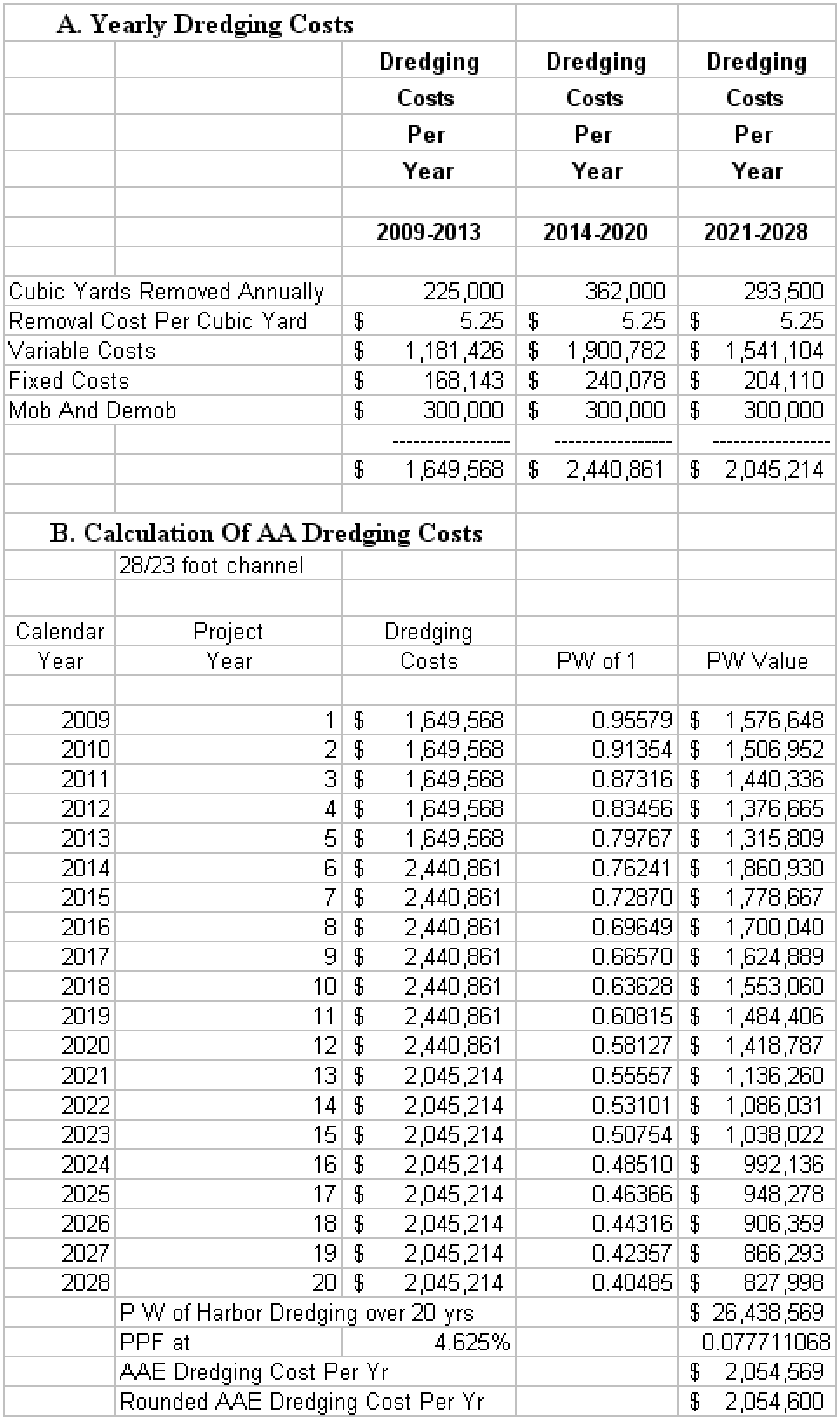
	$ 102,373,200	$ 75,222,000	$ 27,151,200

Table 7. Average Annual Cleveland Harbor Dredging Costs



A. Yearly Dredging Costs

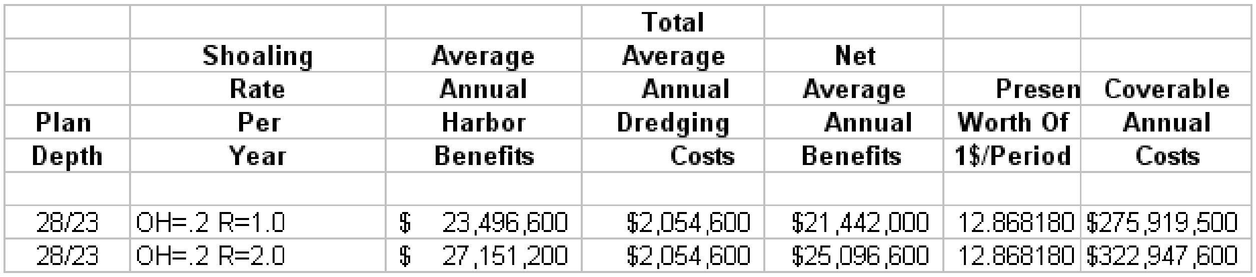
		Dredging Costs Per Year	Dredging Costs Per Year	Dredging Costs Per Year
		2009-2013	2014-2020	2021-2028
Cubic Yards Removed Annually		225,000	362,000	293,500
Removal Cost Per Cubic Yard		$ 5.25	$ 5.25	$ 5.25
Variable Costs		$ 1,181,426	$ 1,900,782	$ 1,541,104
Fixed Costs		$ 168,143	$ 240,078	$ 204,110
Mob And Demob		$ 300,000	$ 300,000	$ 300,000
		----------------	----------------	----------------
		$ 1,649,568	$ 2,440,861	$ 2,045,214

B. Calculation Of AA Dredging Costs

28/23 foot channel

Calendar Year	Project Year	Dredging Costs	PW of 1	PW Value
2009	1	$ 1,649,568	0.95579	$ 1,576,648
2010	2	$ 1,649,568	0.91354	$ 1,506,952
2011	3	$ 1,649,568	0.87316	$ 1,440,336
2012	4	$ 1,649,568	0.83456	$ 1,376,665
2013	5	$ 1,649,568	0.79767	$ 1,315,809
2014	6	$ 2,440,861	0.76241	$ 1,860,930
2015	7	$ 2,440,861	0.72870	$ 1,778,667
2016	8	$ 2,440,861	0.69649	$ 1,700,040
2017	9	$ 2,440,861	0.66570	$ 1,624,889
2018	10	$ 2,440,861	0.63628	$ 1,553,060
2019	11	$ 2,440,861	0.60815	$ 1,484,406
2020	12	$ 2,440,861	0.58127	$ 1,418,787
2021	13	$ 2,045,214	0.55557	$ 1,136,260
2022	14	$ 2,045,214	0.53101	$ 1,086,031
2023	15	$ 2,045,214	0.50754	$ 1,038,022
2024	16	$ 2,045,214	0.48510	$ 992,136
2025	17	$ 2,045,214	0.46366	$ 948,278
2026	18	$ 2,045,214	0.44316	$ 906,359
2027	19	$ 2,045,214	0.42357	$ 866,293
2028	20	$ 2,045,214	0.40485	$ 827,998
	P W of Harbor Dredging over 20 yrs			$ 26,438,569
	PPF at	4.625%		0.077711068
	AAE Dredging Cost Per Yr			$ 2,054,569
	Rounded AAE Dredging Cost Per Yr			$ 2,054,600

Table 8. Cleveland Harbor- Level Of Supportable CDF Project Costs



Plan Depth	Shoaling Rate Per Year	Average Annual Harbor Benefits	Total Average Annual Dredging Costs	Net Average Annual Benefits	Presen Worth Of 1$/Period	Coverable Annual Costs
28/23	OH=.2 R=1.0	$ 23,496,600	$2,054,600	$21,442,000	12.868180	$275,919,500
28/23	OH=.2 R=2.0	$ 27,151,200	$2,054,600	$25,096,600	12.868180	$322,947,600

APPENDIX G
Part II

CLEVELAND HARBOR DMMP ECONOMIC EVALUATION OF ALTERNATIVE PLANS

Economic Evaluation of Alternative Plans

I. INTRODUCTION

The Cleveland Harbor Dredge Material Management Plan (DMMP) is a document that developed a number of plans that would allow dredging at Cleveland harbor to continue for the next 20 years. This Appendix documents the development of these plans, the components of the various plans and their costs. Average annual costs and average annual benefits are identified for each plan and used to develop plan benefit to cost ratios and plan net benefits. The project evaluation period for this DMMP is 2009-2028.

II. MEASURES

The Cleveland Harbor Dredge Material Management Plan (DMMP) developed a number of measures (24), including the "No Action", that could be used to develop plans that addressed the need to dispose of dredged material removed from the harbors river and approach channels for the next 20 years. These 24 measures are listed in Table 1. Figure 1 provides a schematic of potential confined disposal facility (CDF) site locations at Cleveland Harbor associated with Measure D-New CDFs. Table 2 presents a relative comparison of the physical characteristics of the eleven preliminary CDF configurations, which includes an iteration of proposed CDF 2 and CDF 3. (Note: the cost estimates date from June of 2007, and were based on a readily availability source of quarry stone – which is unlikely. These costs are "preliminary costs" and are presented in the table for comparison purposes only).

A. Preliminary Screening of Management Measures

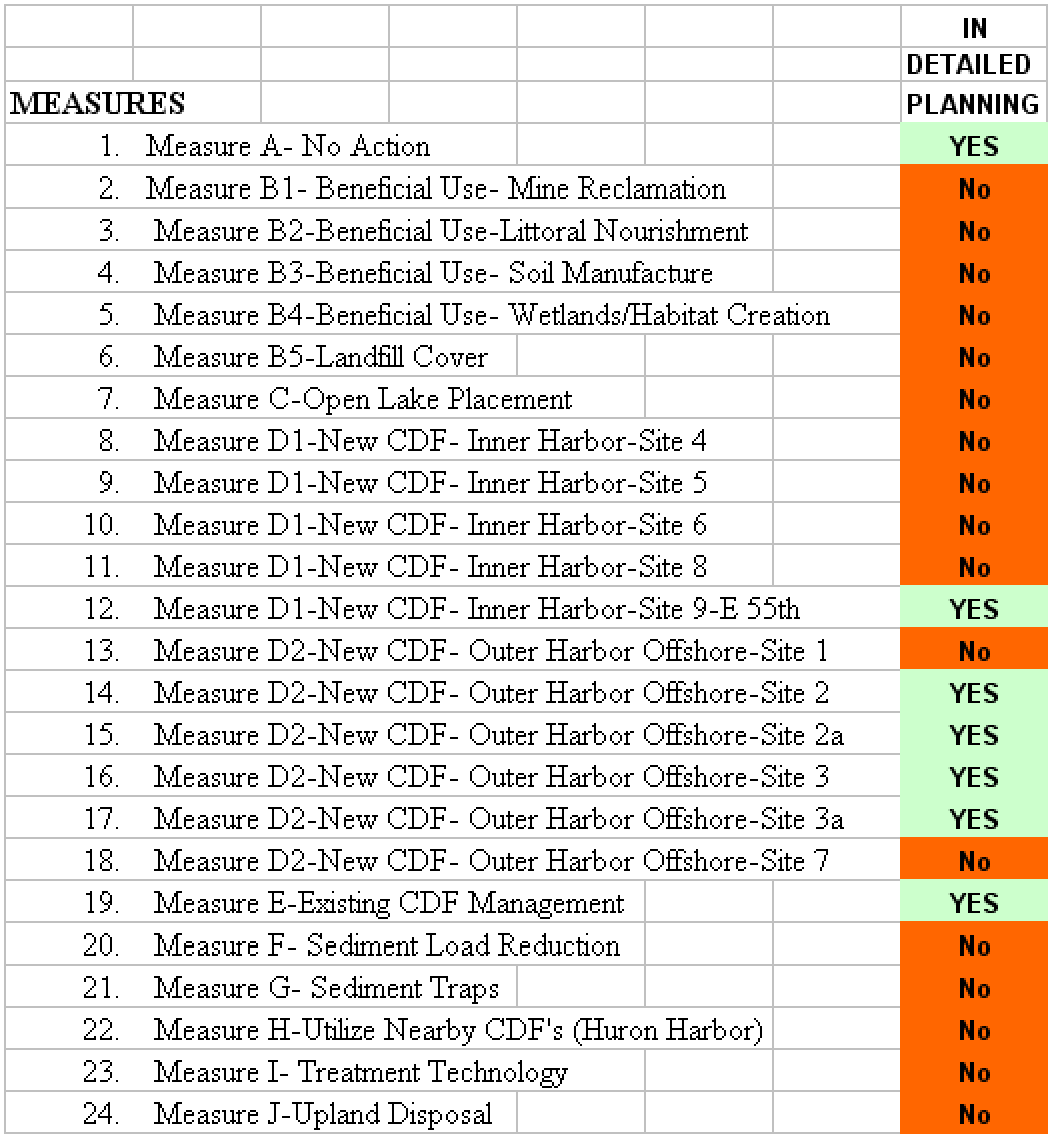
1. Comparing Measures to Objectives – A description of the evaluation process used to determine which measures would be carried into detailed planning starts in Section 2.37 of the main report. The 24 measures identified in Table 1 were compared to the Planning Objectives (Section 2.09 of the main report) developed for this DMMP. A summary of this comparison was provided in Table 2.2 of the main report.

B. Measures Carried Into Detailed Planning

The Cleveland Harbor DMMP identified seven measures, including the No Action, which would be carried into detailed planning. A description of these seven measures follows.

1. Measure A- No Action Under this measure, the Federal Government would do nothing to address the need for future long term placement of dredged material. All USACE CDFs are essentially filled after the 2008 dredging season, given their current configurations. Consequently, all federal action at Cleveland would cease after 2008. There would be no dredging, no breakwater maintenance, no CDF maintenance and no CDF management. (Note: the No Action plan is essentially the Without Project Condition).

Table 1- Initial Measures Identified As Potential Components Of Plans



MEASURES	IN DETAILED PLANNING
1. Measure A- No Action	YES
2. Measure B1- Beneficial Use- Mine Reclamation	No
3. Measure B2-Beneficial Use-Littoral Nourishment	No
4. Measure B3-Beneficial Use- Soil Manufacture	No
5. Measure B4-Beneficial Use- Wetlands/Habitat Creation	No
6. Measure B5-Landfill Cover	No
7. Measure C-Open Lake Placement	No
8. Measure D1-New CDF- Inner Harbor-Site 4	No
9. Measure D1-New CDF- Inner Harbor-Site 5	No
10. Measure D1-New CDF- Inner Harbor-Site 6	No
11. Measure D1-New CDF- Inner Harbor-Site 8	No
12. Measure D1-New CDF- Inner Harbor-Site 9-E 55th	YES
13. Measure D2-New CDF- Outer Harbor Offshore-Site 1	No
14. Measure D2-New CDF- Outer Harbor Offshore-Site 2	YES
15. Measure D2-New CDF- Outer Harbor Offshore-Site 2a	YES
16. Measure D2-New CDF- Outer Harbor Offshore-Site 3	YES
17. Measure D2-New CDF- Outer Harbor Offshore-Site 3a	YES
18. Measure D2-New CDF- Outer Harbor Offshore-Site 7	No
19. Measure E-Existing CDF Management	YES
20. Measure F- Sediment Load Reduction	No
21. Measure G- Sediment Traps	No
22. Measure H-Utilize Nearby CDF's (Huron Harbor)	No
23. Measure I- Treatment Technology	No
24. Measure J-Upland Disposal	No

Figure 1. Existing and Potential CDF Sites at Cleveland Harbor

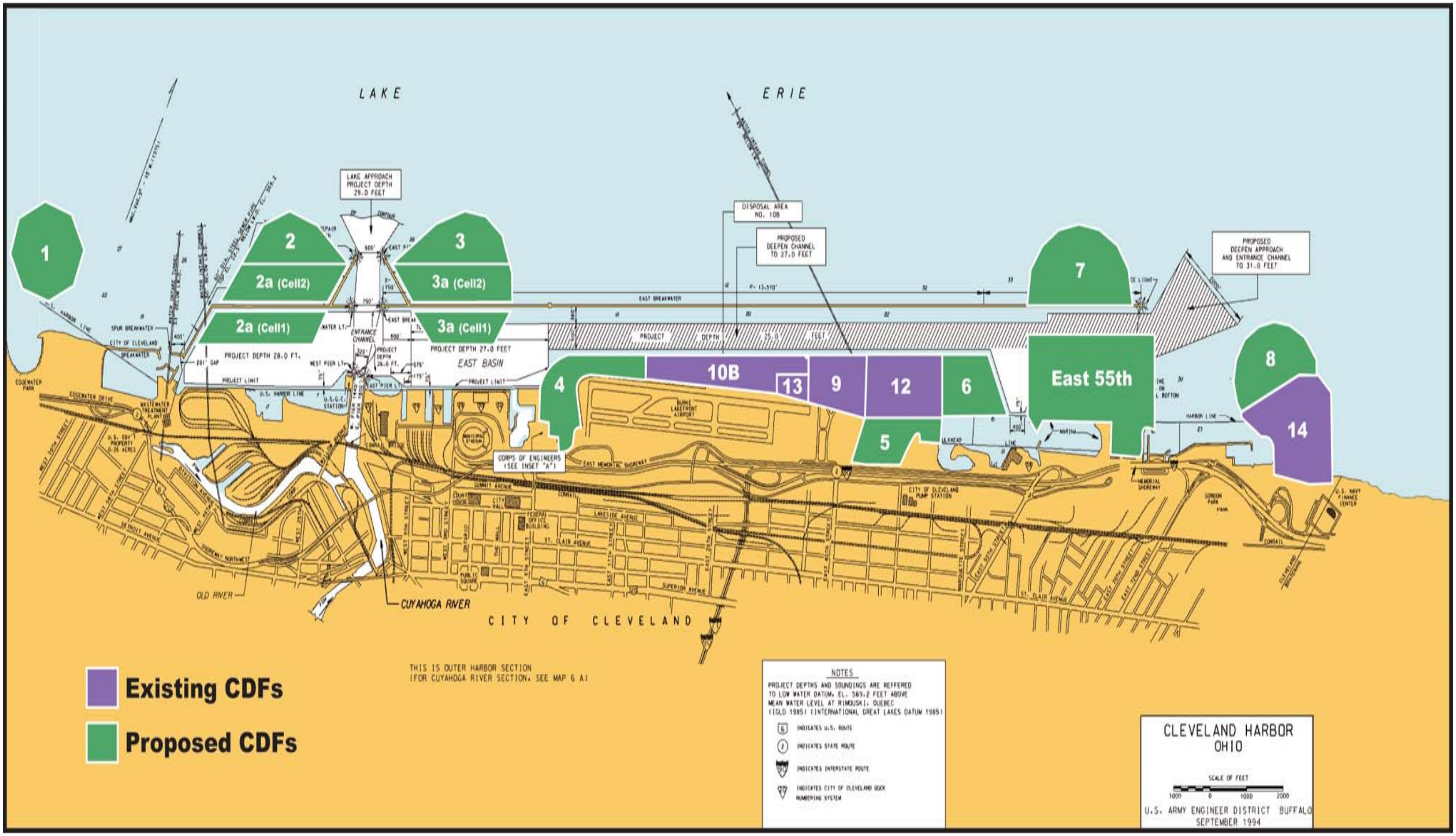


Table 2- Preliminary CDF Characteristics

Proposed Site	Area (acres)	Perimeter (Feet)	Average Existing Lakebed Elevation (feet LWD)	Final Dredge Fill Elevation (feet LWD)	New CDF Perimeter (feet)	Typical X-Sectional Area for New CDF (square feet)	Preliminary Rough Cost Estimate (Millions) (June 2007)	Design Capacity (cy)	Design Capacity (years)*
CDF 1	71	6400	-22	20	6400	4900	$198	4,300,000	13
CDF 2	108	9100	-26	20	9100	6000	$242	7,200,000	21
CDF 2a (Cell 1)	65	8300	-20	10	8300	NA**	$210	2,620,000	8
CDF 2a (Cell 2)	65	8540	-23	20	5250	6000	$115	4,490,000	13
CDF 3	117	9180	-22	20	9400	4900	$210	7,200,000	21
CDF 3a (Cell 1)	50	8300	-17	10	8400	NA**	$132	1,800,000	5
CDF 3a (Cell 2)	79	10680	-22	20	6760	4900	$197	4,650,000	14
CDF 4	61	11400	-17	8	3600	3100	$35	2,300,000	7
CDF 5	36	6600	-14	8	700	2400	$7	1,200,000	3
CDF 6	37	5200	-21	10	3900	3100	$61	1,600,000	5
CDF 7	93	8100	-34	20	8100	8400	$215	6,900,000	20
CDF 8	63	6700	-30	20	4400	7200	$100	4,200,000	12
East 55th Street (LPP)	157	7900	-22	10	7900	NA**	$246	6,850,000	20

***Based on 338,220 cubic yard annual disposal rate.**

****Cell 1 cross section for Alternatives 2a and 3a and the East 55th Street (LPP) includes both rubblemound and vertical steel sheet pile dikes (all other CDF alternatives are exclusively rubblemound; does not allow for equal comparison).**

Without dredging, the navigation channels would progressively shoal in and would result in reduced channel depths for commercial vessels. Reduced channel depths would result in light loading commercial navigation vessels over the 20-year evaluation period. Significant savings would be realized in the Federal budget as expenditures for operating and maintaining the Federal navigation project at Cleveland Harbor would no longer be required. Consistent with USACE guidance (ER 1105-2-100) this measure will be carried forward into detailed planning and fully evaluated in the array of final plans.

2. Measure 12- D1-New CDF- Inner Harbor-Site 9- E 55th The East 55th Street CDF would be approximately 157 acres and provide an estimated 20 years capacity. It met various planning objectives and did not have to be combined with other sites to provide 20 years of capacity.

3. Measure 14- Measure D2-New CDF- Outer Harbor Offshore-Site 2- Site 2 is located along and lakeward of the West Breakwater. The site is 108 acres in size, provides 7.2 million cubic yards of storage and has a lifespan of 21.3 years. It met various planning objectives and did not have to be combined with other sites to provide 20 years of capacity.

4. Measure 15- Measure D2-New CDF- Outer Harbor Offshore-Site 2a- Site 2a would involve the construction of a two celled CDF, one cell located lakeward and one cell located landward of the West Breakwater. Site 2a has a total size of 130 acres, provides 7.1 million cubic yards of space and has a lifespan: 21 years. It met various planning objectives and did not have to be combined with other sites to provide 20 years of capacity.

5. Measure 16- Measure D2-New CDF- Outer Harbor Offshore-Site 3- Site 3 is located along and lakeward of the western end of the East Breakwater. The site is 117 acres in size, provides 7.2 million cubic yards of storage and has a lifespan of 21.3 years. It met various planning objectives and did not have to be combined with other sites to provide 20 years of capacity.

6. Measure 17- Measure D2-New CDF- Outer Harbor Offshore-Site 3a- Site 3a would involve the construction of a two celled CDF, one cell located lakeward and one cell located landward of the East Breakwater. Site 3a has a total size of 123 acres, provides 6.5 million cubic yards of space and has a lifespan of 20 years. It met various planning objectives and did not have to be combined with other sites to provide 20 years of capacity.

7. Measure 19- Measure E-Existing CDF Management One method to continue disposal at existing Cleveland Harbor CDFs is to grade the in-place sediment to generate additional space. Dry sediment within the CDF is harvested to raise the perimeter elevations increasing capacity of the facility. In addition to the increased height of the perimeter, the area where sediment was harvested is now available for disposal of dredged material. Sediment used to raise the perimeter is graded to specific slope and elevation to maximize design capacity and meet design criteria. Trenches are dug to dewater the sediment more quickly and maximize sediment compaction.

Consequently, CDF Management Plans (Best Operational Management Practices-BOMPs) were developed for CDFs 10B, 12 and 9. The implementation of these CDF management plans will allow channel maintenance dredging to continue through 2014.

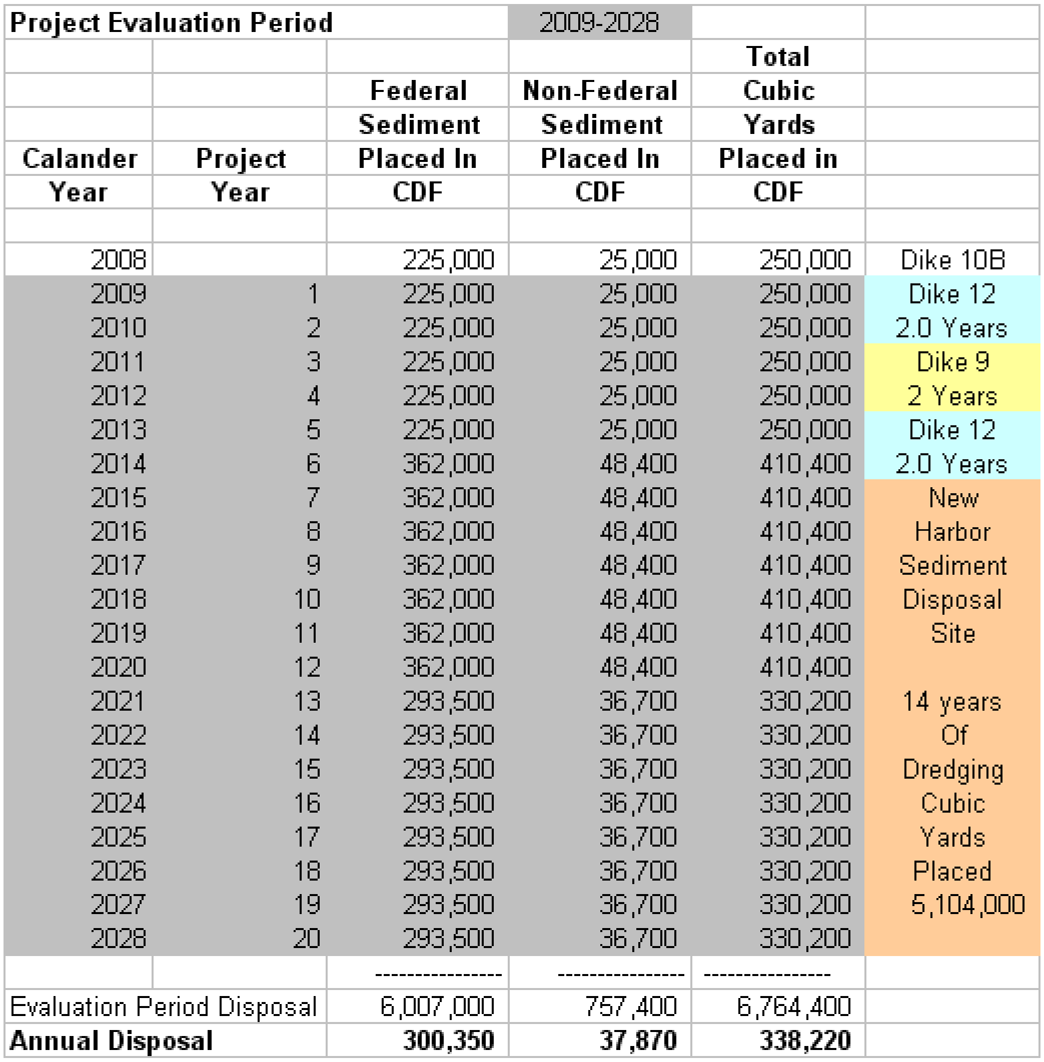
The use of BOMPs at existing CDFs will allow sufficient time for the planning, design and construction of a new CDF and/or development of a new alternative for dredged material disposal at Cleveland. In 2015 a new disposal site will come on line to handle sediment dredged from 2015-2028, the remaining years in the project evaluation period. A brief description of the CDF management plans for CDFs 10B, 12 and 9 follows.

a. Sediment Dredging Schedule Due to the current CDF capacity shortage, dredging will be reduced to 250,000 cubic yards per year (225,000 cubic yards Federal and 25,000 cubic yards non-Federal) from 2008 through 2013 (Table 3). Dredging quantities would likely increase in 2014 to remove accumulated sediments (410,400 annually). Once the backlog has been removed (2020), annual dredging quantities will revert back to 330,200 cubic yards annually (2021-2028). This will result in, approximately 338,220 cubic yards being dredged annually during the twenty year study period. All sediment dredged from Cleveland Harbor will be placed in a CDF. Approximately 6,764,400 cubic yards of sediment will be removed from Cleveland Harbor over the twenty year evaluation period.

b. CDF Management Plan for CDF 10B. Since 1998, all sediment dredged at Cleveland Harbor has been deposited in CDF 10B. After dredging in 2005, CDF 10B was nearly filled with enough remaining capacity for a reduced dredging cycle in 2006. Prior to the 2006 dredging season, USACE implemented Phase I of the Fill Management Plan (FMP) at CDF 10B, and raised the southern perimeter of the CDF by constructing a gradual northward slope with existing dredge material within the CDF. Phase I of CDF 10B FMP allowed for disposal of approximately163,700 cubic yards. In 2007, Phase II of the FMP was implemented to allow for another two seasons (2007, 2008) of reduced dredging and disposal activities.

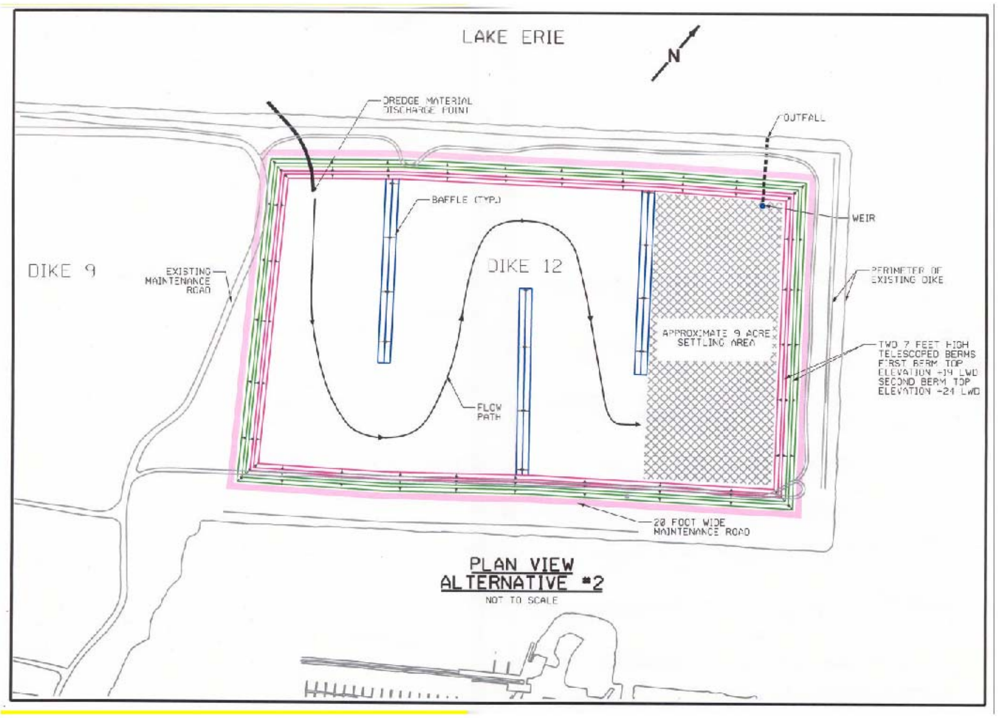
c. CDF Management Plan for CDF 12 CDF 12 is located adjacent to Burke Lakefront (BKL) Airport. Any modifications to CDF 12 will consider the operational requirements of BKL Airport and comply with Federal Aviation Administration (FAA) regulations. FAA regulations limit the height and slope of the CDF perimeter. USACE has developed FMPs to maximize the capacity of existing CDFs while maintaining compliance with FAA regulations. A two-phase FMP has been developed for CDF 12 to accommodate approximately four dredging cycles (2009 through 2010 for Phase 1 and 2013 through 2014 for Phase 2). Figure 2 illustrates the FMP for CDF 12.

Table 3. Cleveland Harbor Sediment Dredging Schedule-2009- 2028



Project Evaluation Period			2009-2028		
Calander Year	**Project Year**	**Federal Sediment Placed In CDF**	**Non-Federal Sediment Placed In CDF**	**Total Cubic Yards Placed in CDF**	
2008		225,000	25,000	250,000	Dike 10B
2009	1	225,000	25,000	250,000	Dike 12
2010	2	225,000	25,000	250,000	2.0 Years
2011	3	225,000	25,000	250,000	Dike 9
2012	4	225,000	25,000	250,000	2 Years
2013	5	225,000	25,000	250,000	Dike 12
2014	6	362,000	48,400	410,400	2.0 Years
2015	7	362,000	48,400	410,400	New
2016	8	362,000	48,400	410,400	Harbor
2017	9	362,000	48,400	410,400	Sediment
2018	10	362,000	48,400	410,400	Disposal
2019	11	362,000	48,400	410,400	Site
2020	12	362,000	48,400	410,400	
2021	13	293,500	36,700	330,200	14 years
2022	14	293,500	36,700	330,200	Of
2023	15	293,500	36,700	330,200	Dredging
2024	16	293,500	36,700	330,200	Cubic
2025	17	293,500	36,700	330,200	Yards
2026	18	293,500	36,700	330,200	Placed
2027	19	293,500	36,700	330,200	5,104,000
2028	20	293,500	36,700	330,200	
		----------------	----------------	----------------	
Evaluation Period Disposal		6,007,000	757,400	6,764,400	
Annual Disposal		**300,350**	**37,870**	**338,220**	

Figure 2. - Fill Management Plan CDF 12



The proposed two-phased FMP at CDF 12 involves phased grading to create two 6-foot perimeter lifts (i.e., berms) using existing dredge material from the CDF. The top elevation of the first lift/berm (Phase 1) is at +18 LWD.

The second lift/berm (Phase 2) shall be graded to +24 LWD after the CDF has reached the capacity provided by the first phase of work. A minimum two-foot freeboard shall be maintained over the entire area. The FMP was also designed to reduce the area of open water in the CDF to inhibit waterfowl nesting, foraging, and loafing. The FMP will be developed and implemented in stages, dependent on funding, design issues and scheduling/coordination with dredging operations. Construction of the first phase of this FMP will be completed in FY09. Construction of the second phase of the FMP should be complete in FY13 and will be used to receive material in 2013 and 2014.

<u>d. CDF Management Plan for CDF 9</u> CDF 9 is a 21-acre facility. Proposed berms will be constructed using sediment currently within the CDF. The berms will tie into CDF 10B and CDF 12 berms on the west and east sides of the CDF, respectively. This will essentially create one large CDF to allow for more effective material deposition, decanting, and dewatering. Proposed elevations of the berms are to be approximately 587.2 feet above MWL. Some changes to the CDFs design are anticipated as coordination with the Cleveland Port Authority, a major stakeholder, continues to devise a plan to avoid disruption of the Burke Lakefront Airport Instrument Landing System (ILS) and weather station. Planned use of CDF 9 is in 2011 and 2012.

The USACE, Buffalo District has constructed a number of in-lake CDFs that have been filled or are essentially filled. These facilities can and have been managed to extend their useful life to accept dredged materials. Such measures typically involve construction of interior berms with sandy dredged material to increase the capacity of the

CDF, as described above. These measures are extremely cost effective in that they utilize existing CDF footprints.

III. PLANS DEVELOPED AND EVALUATED IN DETAIL-COMPONENTS

The seven measures carried forward to detailed planning were used to develop a range of plans that would allow the harbor to be maintained over the 20 year evaluation period 2009-2028. Seven plans were developed using these seven measures. These seven Plans are:

- Alternative Plan 1 – No Action
- Alternative Plan 2 – Management of Existing CDFs and Construction of CDF 2
- Alternative Plan 2a – Management of Existing CDFs and Construction of CDF 2a
- Alternative Plan 3 – Management of Existing CDFs and Construction of CDF 3
- Alternative Plan 3a - Management of Existing CDFs and Construction of CDF 3a
- Alternative Plan 4 – Management of Existing CDFs and Construction of new CDF at the foot of East 55th Street, Corps Configuration
- Alternative Plan 4a- Management of Existing CDFs and Construction of new CDF at the foot of East 55th Street, Locals Configuration.

These plans are presented in detail in the main report. All plan costs represent December 2008 prices. Table 4 provides the various components of the seven alternative plans and general plan characteristics such as cubic capacity, acres, average cubic yards removed per year, lifespan, CDF construction costs, and costs per cubic yard based on construction costs. Plans 2 through 4a have a common component: a FMP for CDFs 12 and 9.

A. Alternative Plan 1-No Action

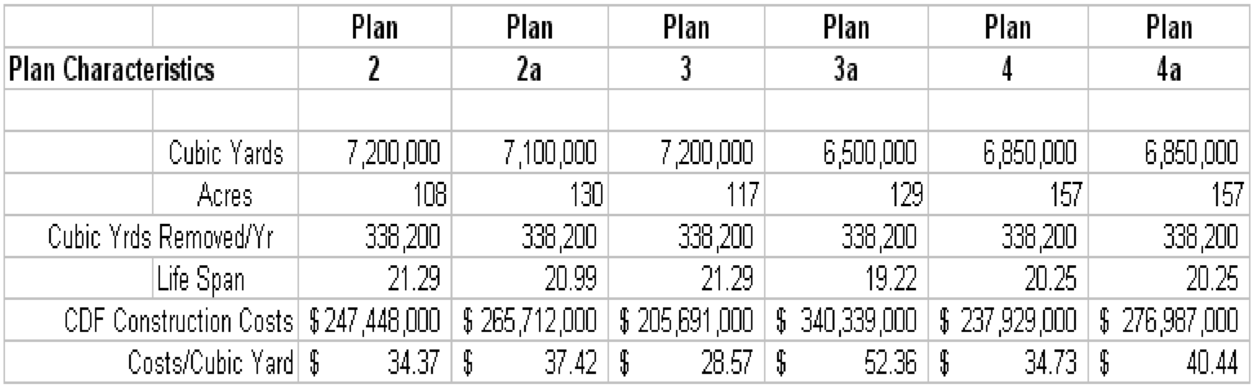
The No Action Plan implies that no short term or long term measure for management of dredged material from Cleveland Harbor will be undertaken during the Planning Evaluation period (2009-2028). Under the No Action plan, all expenditures associated with dredging would cease in project year one, 2009. Future sediments deposited in commercial navigation channels from shoaling over the twenty year evaluation period (2009-2028) would not be dredged and would result in reduced channel depths for commercial vessels. Again, since dredging would cease in Project year 1, there would also be no FMP costs during the project evaluation period.

Table 4- Cleveland DMMP Plan Components

A. Plan Components

Alternative Plans	Management Measures		
	(A)	**(D)**	**(E)**
	No Action	**New CDF**	**Fill Mgmt Plan at Existing CDFs**
Alternative Plan 1 No Action	**X**		
Alternative Plan 2- New CDF- Site 2		**X**	**X**
Alternative Plan 2a New CDF-Site 2a		**X**	**X**
Alternative Plan 3 New CDF-Site 3		**X**	**X**
Alternative Plan 3a New CDF-Site 3a		**X**	**X**
Alternative Plan 4 New CDF-E55th St Corps Configuration		**X**	**X**
Alternative Plan 4a New CDF-E55th St Locals Configuration		**X**	**X**

B. General Plan Characteristics



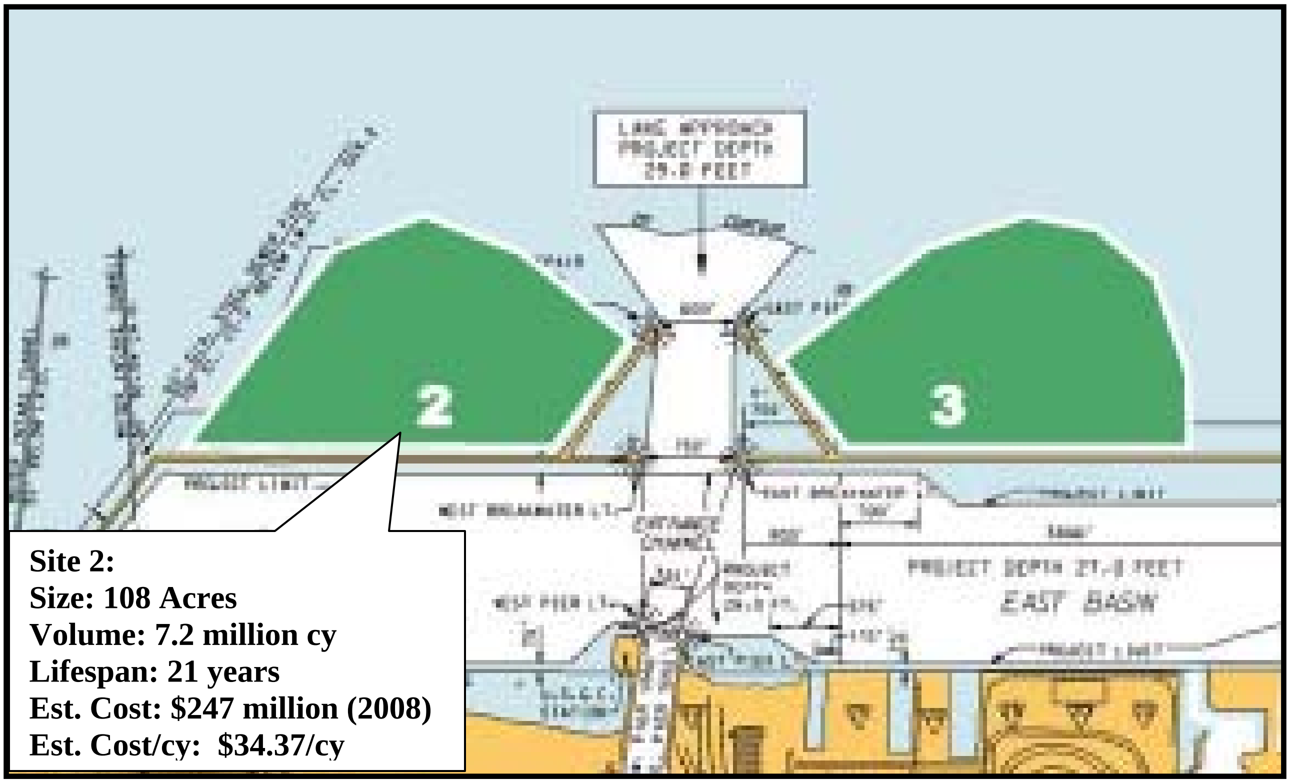
Plan Characteristics	Plan 2	Plan 2a	Plan 3	Plan 3a	Plan 4	Plan 4a
Cubic Yards	7,200,000	7,100,000	7,200,000	6,500,000	6,850,000	6,850,000
Acres	108	130	117	129	157	157
Cubic Yrds Removed/Yr	338,200	338,200	338,200	338,200	338,200	338,200
Life Span	21.29	20.99	21.29	19.22	20.25	20.25
CDF Construction Costs	$ 247,448,000	$ 265,712,000	$ 205,691,000	$ 340,339,000	$ 237,929,000	$ 276,987,000
Costs/Cubic Yard	$ 34.37	$ 37.42	$ 28.57	$ 52.36	$ 34.73	$ 40.44

B. Alternative Plan 2-New CDF- Site 2

Alternative Plan 2 includes implementation of the FMP from 2009 through 2014 at CDFs 12 and 9 and construction of a new CDF at Site 2. Site 2 is located along and lakeward side of the

West Breakwater. CDF 2 is 108 acres in size and is in about 34 feet of water (Figure 3). The capacity of CDF 2 is around 7,200,000 cubic yards.

Figure 3.- Location Of Plan 2- New CDF- Site 2



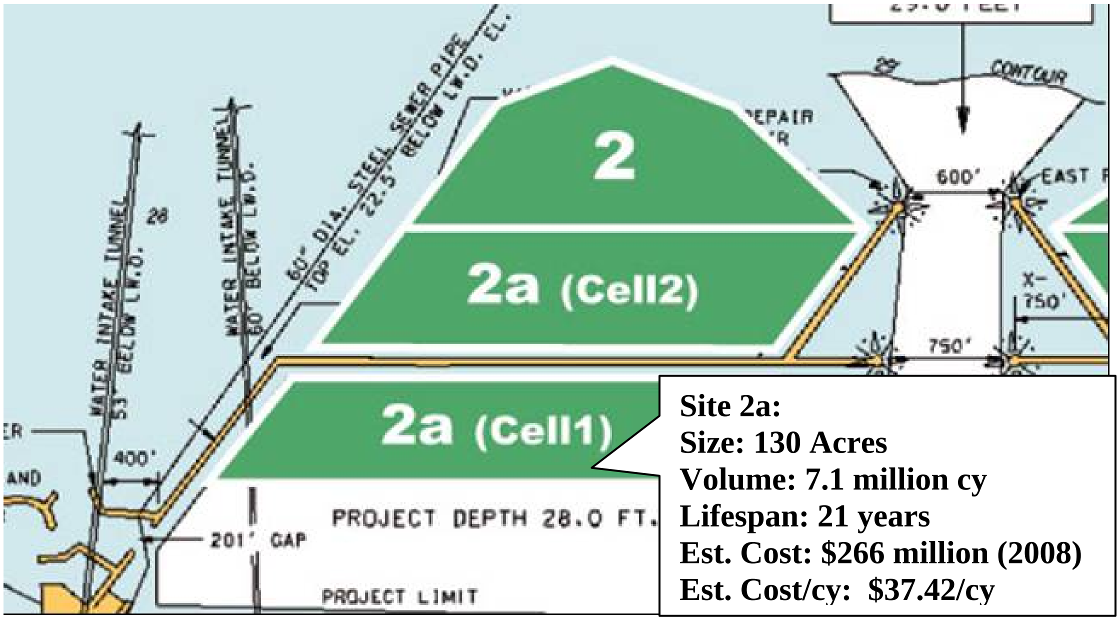
Site 2:
Size: 108 Acres
Volume: 7.2 million cy
Lifespan: 21 years
Est. Cost: $247 million (2008)
Est. Cost/cy: $34.37/cy

Implementation costs associated with Plan 2 include CDF management costs, dredging costs, fish habitat development and new CDF construction costs. CDF management costs for Plan 2 include FMP costs for CDFs 9 and 12. CDF management costs associated with CDF 12 are approximately $4,818,000. This money would be expended evenly in 2009 and 2013. Management costs associated with CDF 9 are approximately $2,409,000. This money would be expended in 2011. Costs associated with putting the sediments into existing Cleveland Harbor CDFs from 2009-2014 are range from $1,674,100 to $2,520,200 per dredging event. Cost associated with putting the sediments into the new CDF (2015-2028) range from $2,287,100 to $2,739,200 per dredging event. The plan also includes the development of fish spawning habitat along the outside of new and existing CDFs ($500,000). Rubblemound construction of the new CDF would take place in approximately 34 feet of water, be constructed over a three year period (2012, 2013, 2014), and cost $247,448,000.

C. Alternative Plan 2a-New CDF- Site 2a

Plan 2a includes implementation of the FMP from 2009 through 2014 at CDFs 12 and 9 and construction of a new two celled CDF at Site 2a on the West Breakwater. One cell would be located lakeward and one cell located landward of the West Breakwater. Site 2a has a total size of 130 acres, provides 7.1 million cubic yards of space, has a lifespan of 21 years, and construction costs of $265,712,000 (Figure 4).

Figure 4. Location Of Plan 2a- New CDF- Site 2a



Site 2a:
Size: 130 Acres
Volume: 7.1 million cy
Lifespan: 21 years
Est. Cost: $266 million (2008)
Est. Cost/cy: $37.42/cy

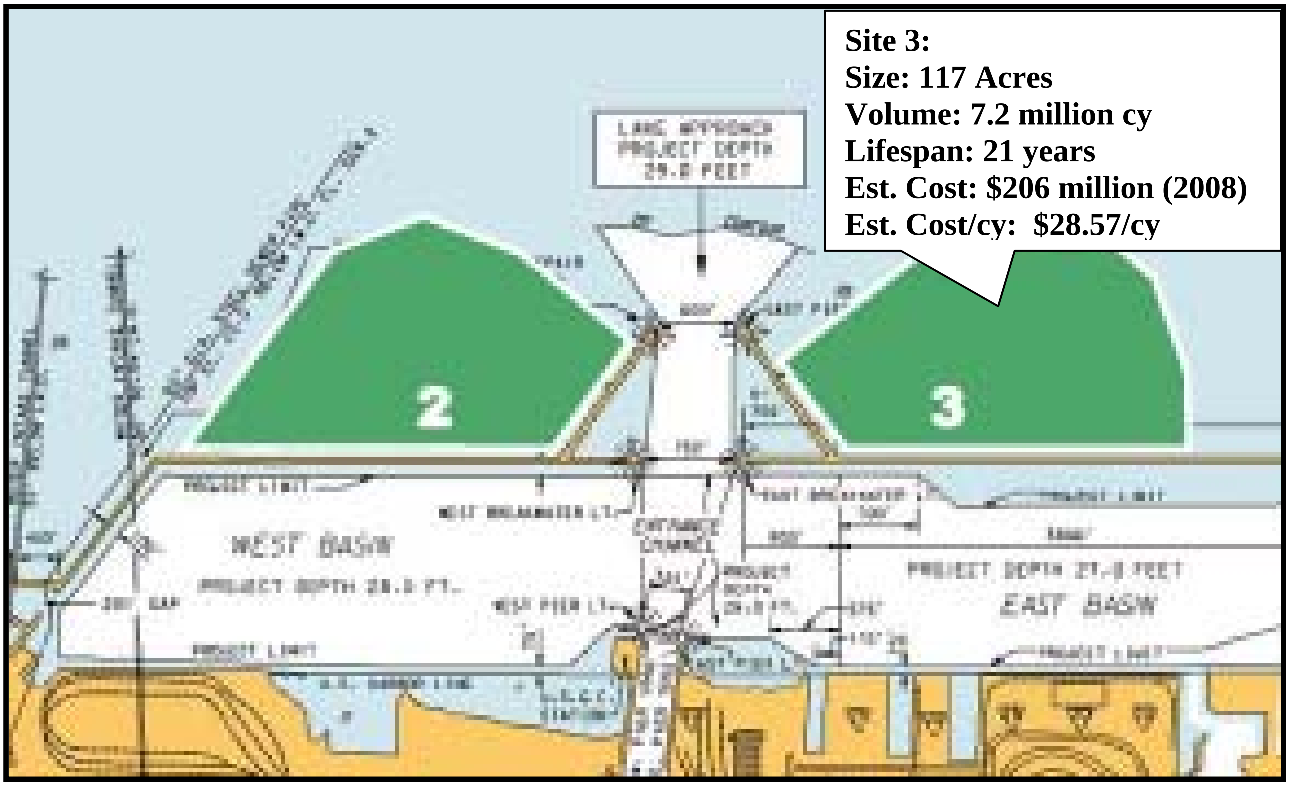
Cell 1, to be constructed and available for disposal of dredged material in 2015, would be approximately 65 acres in size. Construction of cell 1 would include the existing wall of the West Breakwater as the northern perimeter. To the east and south, cell 1 would be constructed of new perimeter walls, consisting of steel sheet pile construction. This cell would be subdivided as necessary to improve the operational aspects of dredged material disposal. Cell 1 would be designed to have a life of about eight years assuming the average annual disposal of about 390,000 cubic yards during this time (about 3,122,800 cubic yards total). Cell 1 would be operational from 2015 through 2022. Upon filling cell 1 the area would be transferred to the local sponsor. Cell 2 of alternative plan 2a would be constructed to include the West Breakwater as the southerly wall and would be operational from 2023 through 2034. It would be designed to have an estimated capacity of 4,100,000 cubic yards for a life of twelve years at 338,200 cubic yards per year. The north wall of cell 2 would probably be constructed of stone to deflect wave action present in this unprotected area. Implementation of Alternative Plan 2a would require de-authorization of the rarely used and rarely dredged portion of the harbor encroached upon by cell 1 of the CDF.

Implementation costs associated with Plan 2a include CDF management costs, dredging costs, fish habitat development and new CDF construction costs. CDF management costs for Plan 2a include CDF Management costs for CDF 12 and CDF 9. CDF management costs associated with CDF 12 are approximately $4,818,000. This money would be expended evenly in 2009 and 2013. Management costs associated with CDF 9 are approximately $2,409,000. This money would be expended in 2011. Costs associated with putting the sediments into existing Cleveland Harbor CDFs from 2009-2014 range from $1,674,100 to $2,520,200 per dredging event. Cost associated with putting the sediments into the new CDF at Cell 1(2015-2022) range from $1,948,100 to $2,321,100 per dredging event. Cost associated with putting the sediments into the new CDF at Cell 2 (2023-2028) range from $1,948,100 to $2,287,100 per dredging event. The plan also includes the development of fish spawning habitat along the outside of new and existing CDFs ($500,000). Rubblemound construction of Cell 1 would take place in approximately 28 feet of water, be constructed over a three year period (2012, 2013, 2014), and cost $119,913,000. Rubblemound construction of Cell 2 would take place in approximately 32 feet of water, be constructed over a three year period (2020, 2021, 2022), and cost $145,799,000.

D. Alternative Plan 3-New CDF- Site 3

Alternative Plan 3 includes implementation of the FMP from 2009 through 2014 at CDFs 12 and 9 and building a new CDF at Site 3. Site 3 is located along and lakeward of the western end of the East Breakwater. The site is 117 acres in size, provides 7.2 million cubic yards of storage and has a lifespan of 21 years. Figure 5 provides a schematic of the CDF location and layout.

Figure 5. Location Of Plan 3- New CDF- Site 3



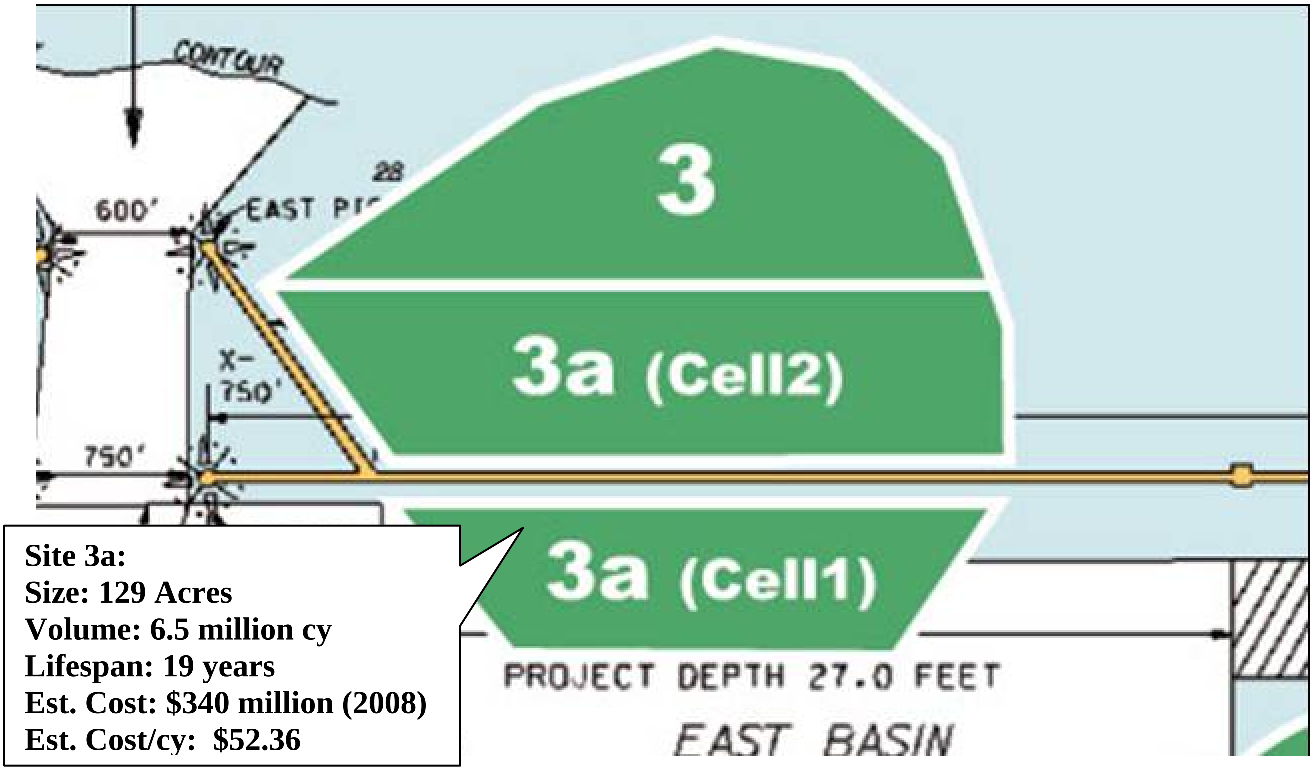
Site 3:
Size: 117 Acres
Volume: 7.2 million cy
Lifespan: 21 years
Est. Cost: $206 million (2008)
Est. Cost/cy: $28.57/cy

Implementation costs associated with Plan 3 include CDF management costs, dredging costs, fish habitat development and new CDF construction costs. CDF management costs for Plan 3 include CDF management costs for CDF 12 and CDF 9. CDF management costs associated with CDF 12 are approximately $4,818,000. This money would be expended evenly in 2009 and 2013. Management costs associated with CDF 9 are approximately $2,409,000. This money would be expended in 2011. Costs associated with putting the sediments into existing Cleveland Harbor CDFs from 2009-2014 range from $1,674,100 to $2,520,200 per dredging event. Cost associated with putting the sediments into the new CDF (2015-2028) range from $2,287,100 to $2,739,200 per dredging event. The plan also includes the development of fish spawning habitat along the outside of new and existing CDFs ($500,000). Rubblemound construction of the new CDF would take place in approximately 34 feet of water, be constructed over a three year period (2012, 2013, 2014), and cost $205,691,000.

E. Alternative Plan 3a-New CDF- Site 3a

Alternative Plan 3a includes implementation of the FMP from 2009 through 2014 at CDFs 12 and 9 and the construction of a two celled CDF at Site 3a, one cell located lakeward and one cell located landward of the East Breakwater (Figure 6). Site 3a has a total size of 129 acres, provides 6.5 million cubic yards of space, has a 19 year lifespan and construction costs of $340,339,000. Site 3a would be similar in configuration to that presented for Alternative Plan 2a

Figure 6. Location Of Plan 3a- New CDF- Site 3a



Site 3a:
Size: 129 Acres
Volume: 6.5 million cy
Lifespan: 19 years
Est. Cost: $340 million (2008)
Est. Cost/cy: $52.36

The relationship between Alternative 3 and 3a is analogous to that of 2 and 2a. The primary difference is that Alternative 3a will be constructed in shallower water depths which will reduce construction costs on a per lineal foot basis. Cell 1, to be constructed and available for disposal of dredged material in 2015, would be approximately 75 acres in size. Construction of cell 1 would include the existing wall of the East Breakwater as the northern perimeter. To the east, south, and west, cell 1 would be constructed of new perimeter walls, consisting of steel sheet pile construction. This cell would be subdivided as necessary to improve the operational aspects of dredged material disposal. Cell 1 would be designed to have a life of about five years assuming the average annual disposal of about 410,000 cubic yards (about 2,000,000 cubic yards total). Cell 1 would be operational from 2015 through 2019. Upon filling cell 1 the area would be transferred to the local sponsor. Cell 2 of alternative plan 3a would be constructed to include the East Breakwater as the southerly wall and would be operational from 2020 through 2034. It would be designed to have an estimated capacity of 4,300,000 cubic yards for a life of thirteen years at 338,200 cubic yards per year. The north wall of cell 2 would probably be constructed of stone to deflect wave action present in this unprotected area. Implementation of Alternative Plan 3a would require de-authorization of the rarely used and rarely dredged portion of the harbor encroached upon by Cell 1 of the CDF.

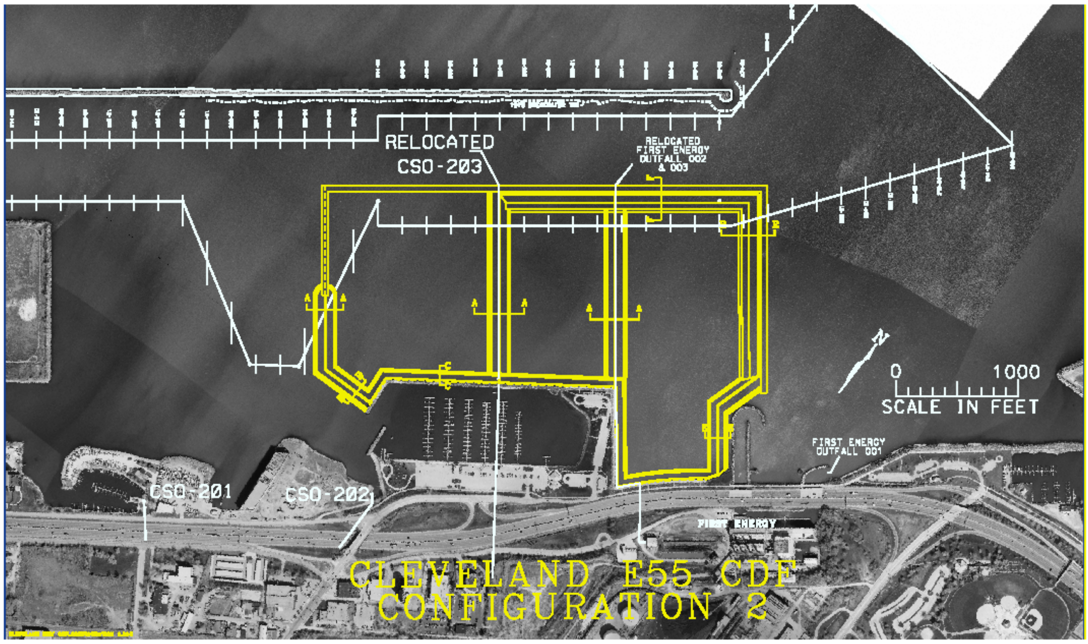
Implementation costs associated with Plan 3a include CDF management costs, dredging costs, fish habitat development and new CDF construction costs. CDF management costs for Plan 3a include CDF management costs for CDF 12 and CDF 9. CDF management costs associated with CDF 12 are approximately $4,818,000. This money would be expended evenly in 2009 and 2013. Management costs associated with CDF 9 are approximately $2,409,000. This money would be expended in 2011. Costs associated with putting the sediments into existing Cleveland

Harbor CDFs from 2009-2014 range from $1,674,100 to $2,520,200 per dredging event. Cost associated with putting the sediments into the new CDF at Cell 1 (2015-2019) are $2,360,900 per dredging event. Cost associated with putting the sediments into the new CDF at Cell 2 (2020-2028) range from $1,980,400 to $2,360,900 per dredging event. The plan also includes the development of fish spawning habitat along the outside of new and existing CDFs ($500,000). Rubblemound construction of Cell 1 would take place in approximately 28 feet of water, be constructed over a three year period (2012, 2013, 2014), and cost $138,789,000. Rubblemound construction of Cell 2 would take place in approximately 32 feet of water, be constructed over a three year period (2017, 2018, 2019), and cost $201,550,000.

F. Alternative Plan 4-New CDF- East 55th Street-Corps Configuration

Alternative Plan 4 includes implementation of the FMP from 2009 through 2014 at CDFs 12 and 9 and the construction of CDF 9 (East 55th Street CDF). This plan would involve the construction of a CDF at the East 55th Street location as illustrated in Figure 7. The CDF is approximately 157 acres in size, provides 6,850,000 cubic yards of capacity and has a 20 year life span. To the south, the East 55th Street site will be bounded by an improved State Park Marina breakwater, the natural shoreline near the terminus of East 55th Street, and a to-be-constructed perimeter wall/CDF. A portion of the eastern boundary would be formed by the existing First Energy circulating water intake (necessary improvements will be made to the structure) and the remainder of the perimeter shown will be formed by still to be constructed walls. The perimeter walls will be back to back open cell construction. The CDF will be constructed in optimally sized cells in order to spread out construction costs over time while still maintaining cost effectiveness. Three individual cells will be constructed. The combined footprint will not exceed what is shown in Figure 7. The entire facility provides 20 years of capacity assuming an annual dredging volume of about 338,220 cubic yards per year. The first cell would be constructed from 2012 through 2014, allowing filling operations to begin in FY15.

Figure 7. Location Of Plan 4- New CDF- Site 9- E. 55th Street-Corps Configuration



The proposed footprint of the East 55th Street site encroaches on the existing Federal approach channel in the east basin and eastern flared portion of the 25-foot deep dock approach channel to the former Nicholson Cleveland Terminal Company pier. These portions of the existing project were authorized but never constructed. These portions of the channel must be de-authorized in order to implement the proposed East 55th Street CDF alternative.

Implementation costs associated with Plan 4 include CDF management costs, dredging costs, water outfall relocation costs, fish habitat development and new CDF construction costs. CDF management costs for Plan 4 include CDF management costs for CDF 12 and CDF 9. CDF management costs associated with CDF 12 are approximately $4,818,000. This money would be expended evenly in 2009 and 2013. Management costs associated with CDF 9 are approximately $2,409,000. This money would be expended in 2011. Costs associated with putting the sediments into existing Cleveland Harbor CDFs from 2009-2014 range from $1,674,100 to $2,520,200 per dredging event. Costs associated with putting sediments into the new CDF at Cell 1 (2015-2021) range from $2,174,100 to $2,599,800 per dredging event. Cost associated with putting the sediments into the new CDF at Cell 2 (2022-2026) range from $2,141,800 to $2,174,100 per dredging event. Cost associated with putting the sediments into the new CDF Cell 3 (2027-2034) are $2,141,800.

There are two water outfalls (a 42 inch diameter and a 14 foot diameter outfall) that will have to be extended approximately 1,000 feet. Extension of these outfalls have a total cost $7,591,500 and would take place in two stages. The first extension would start in 2014 ($5,091,491) and the second extension ($2,500,000) in 2021. The plan also includes the development of fish spawning habitat along the outside of the CDF ($500,000).

Construction costs for Plan 4 are $237,929,000. Construction of Cell 1 would take place in approximately 25 feet of water, be constructed over a three year period (2012, 2013, 2014), and cost $110,450,000. Construction of Cell 2 would take place in approximately 28 feet of water, be constructed over a three year period (2019, 2020, 2021), and cost $54,091,000. Construction of Cell 3 would take place in approximately 28 feet of water, be constructed over a three year period (2024, 2025, 2026), and cost $73,388,000.

G. Alternative Plan 4a-New CDF- East 55th Street-Local Configuration

This plan would be identical in acreage and capacity as Plan 4. However, the vertical perimeter walls would be required to accommodate possible future development activities on the CDF. The engineering components of the steel sheet pile (i.e. vertical and lateral strength) would thus be greater than that used to construct Alternative Plan 4. The CDF would be 157 acres in size, provide 6,850,000 cubic yards of sediment capacity and have a 20 year life span.

The CDF will be constructed in optimally sized cells in order to spread out construction costs over time while still maintaining cost effectiveness. Three individual cells will be constructed. The proposed footprint of the East 55th Street site encroaches on the existing Federal approach channel in the east basin and eastern flared portion of the 25-foot deep dock approach channel to the former Nicholson Cleveland Terminal Company pier. These portions of the existing project were authorized but never constructed. These portions of the channel must be de-authorized in order to implement the proposed East 55th Street CDF alternative.

Implementation costs associated with Plan 4a include CDF management costs, dredging costs, water outfall relocation costs, fish habitat development, and new CDF construction costs. CDF management costs for Plan 4a include CDF management costs for CDF 12 and CDF 9. CDF management costs associated with CDF 12 are approximately $4,818,000. This money would be expended evenly in 2009 and 2013. Management costs associated with CDF 9 are approximately $2,409,000. This money would be expended in 2011. Costs associated with putting the sediments into existing Cleveland Harbor CDFs from 2009-2014 range from $1,674,100 to $2,520,200 per dredging event. Cost associated with putting sediments into the new CDF at Cell 1 (2015-2021) range from $2,174,100 to $2,599,800 per dredging event. Cost associated with putting the sediments into the new CDF at Cell 2 (2022-2026) range from $2,141,800 to $2,174,100 per dredging event. Cost associated with putting the sediments into the new CDF at Cell 3 (2027-2034) are $2,141,800.

There are two water outfalls (a 42 inch diameter and a 14 foot diameter outfall) that will have to be extended approximately 1,000 feet. Extension of these outfalls have a total cost $6,520,300 and would take place in two stages. The first extension would start in 2014 ($4,077,100) and the second extension ($2,443,200) in 2021. The plan also includes the development of fish spawning habitat along the outside of new and existing CDFs ($500,000).

Construction costs for Plan 4a are $276,987,000. Construction of Cell 1 would take place in approximately 25 feet of water, be constructed over a three year period (2012, 2013, 2014), and cost $129,667,000. Construction of Cell 2 would take place in approximately 28 feet of water, be constructed over a three year period (2019, 2020, 2021), and cost $60,513,000. Construction of Cell 3 would take place in approximately 28 feet of water, be constructed over a three year period (2024, 2025, 2026), and cost $86,807,000.

H. Alternative Plan Dredging Costs

1. Introduction Dredging costs per dredging event were calculated for each alternative. There are a number of pieces of information that need to be known before dredging costs can be calculated. These include frequency of dredging, cubic yards removed per cycle, the quality of the sediments and location of disposal sites (CDF / Open Lake). Once this information is known, fixed and variable costs for dredging associated with the various plans, can be calculated.

2. Dredging Frequency, Cubic Yards Removed Per Dredging Event, Sediment Quality The need for maintenance dredging arises from the buildup of shoal material in the navigation channels which leads to the restriction of the flow of commercial navigation. The need to dredge portions of the Outer harbor, Old River Channel, and Cuyahoga River depends upon the continued operation of the various docks that receive the major bulk commodities that use Cleveland Harbor: iron ore, limestone, cement and concrete, salt, and sand, gravel and crushed rock.

Cleveland Harbor is dredged annually in the spring and fall. Although Cleveland Harbor has dredging occurring twice in a given year, both dredging events are let under one contract and all dredging is performed by one dredge. Thus the harbor is said to be dredged annually. However, only the Cuyahoga River channel is dredged each year. The Old River and Outer Harbor, which experience much less shoaling than the Cuyahoga River, are dredged on average once every five years. All material dredged from Cleveland Harbor is deposited in a CDF.

There is an abundance of historic data on the volume of material removed from the harbor each year. The data indicate that on the average 273,500 cubic yards of material are dredged from the Cuyahoga River each year. In addition, on average 50,000 cubic yards are removed each time the Outer Harbor or the Old River channels are dredged. The latter two channels are dredged every fifth year. Therefore, together, they add, on a yearly average, an additional 20,000 cubic yards to the 273,500 cubic yards annually dredged from the Cuyahoga River. Thus in total, an average of 293,500 cubic yards of material are projected to be removed from

Cleveland Harbor Federal channels each year. It is projected that this volume will be removed each year through the 20-year evaluation period.

Non-Federal dredging activities during this same time period resulted in an average of 36,700 cubic yards. Average total in place cubic yards removed (Federal and non-Federal) per dredging event for the time period 1998-2003 was 330,200 (Table 5).

Table 5.
Recent Dredging History (In Place Cubic Yards Per Year [1])

	Year 1998	Year 1999	Year 2000	Year 2001	Year 2002	Year 2003	Average	Disposal Site
Federal Dredging	335,900	281,700	225,600	401,800	182,000 [2]	333,900 [3]	293,500	CDF
Non Federal	24,700	25,100	107,400	23,700	11,800	27,600	36,700	CDF
Total Dredging	360,600	306,800	333,000	425,500	193,800	361,500	330,200	CDF

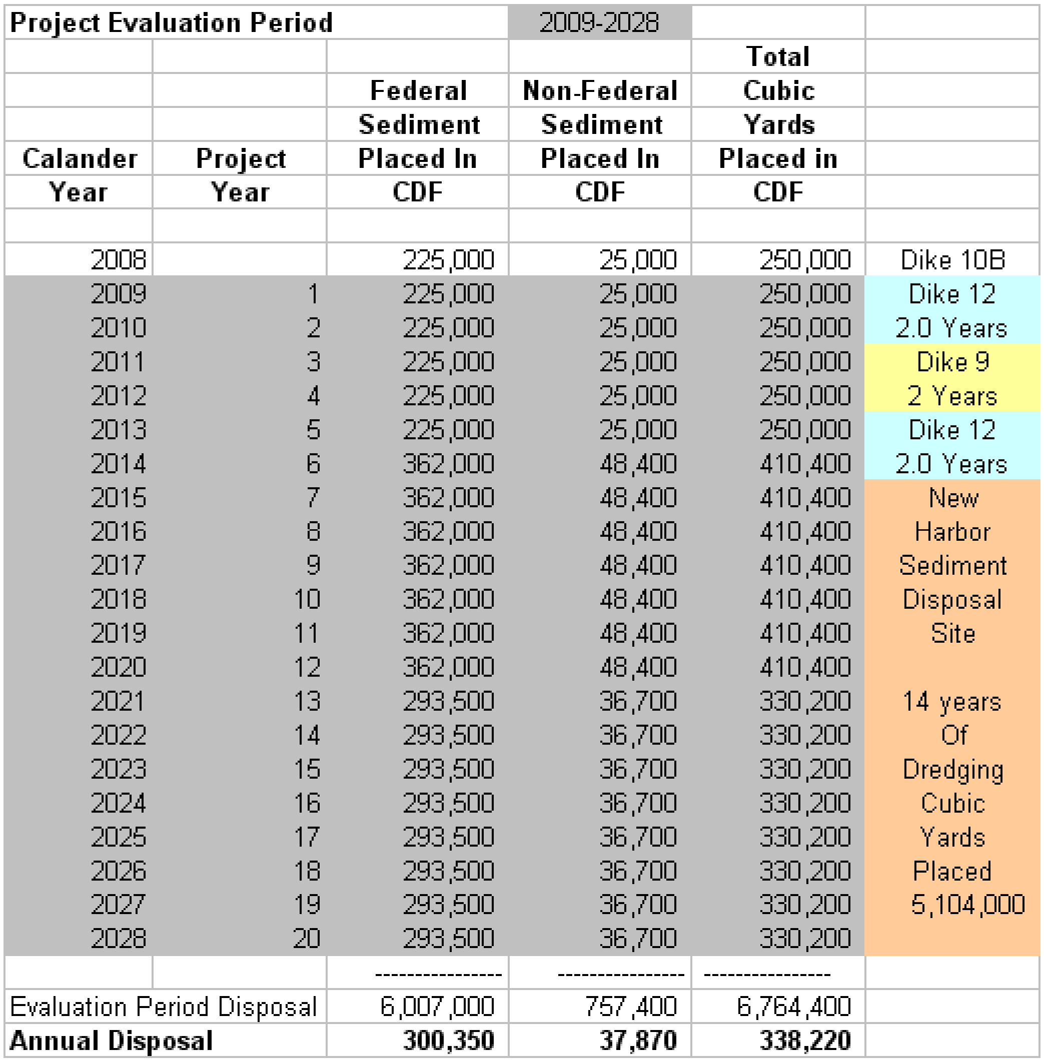
1. All volumes are "In Place" volumes.
2. Dredging operations were limited by available funds. Actual quantities dredged in 2002 do not necessarily reflect the required dredging volumes if sufficient O&M appropriations were available.
3. Preliminary estimate of in place Federal cubic yards dredged in 2003.

Given the reduction in operation and maintenance budgets in recent years, and the growing lack of space in existing CDFs for future dredging cycles, quantities dredged at Cleveland Harbor in recent years have been well below these historical volumes. The DMMP estimated how many cubic yards of sediment would need to be dredged yearly over the project evaluation period 2009-2028. Channel maintenance of Cleveland Harbor necessitates the removal of approximately 338,220 cubic yards annually.

Due to the current CDF capacity shortage, dredging will be reduced to 250,000 cubic yards per year (225,000 cubic yards Federal and 25,000 cubic yards non-Federal) from 2008 through 2013 (Table 6). Dredging quantities would likely increase in 2014 to remove accumulated sediments (410,400 annually). Once the initial backlog has been removed (2020), annual dredging quantities will revert back to 330,200 cubic yards annually (2021-2028). This will result in, approximately 338,220 cubic yards being dredged annually during the twenty year study period. Again, all sediment dredged from Cleveland Harbor will be placed in a CDF.

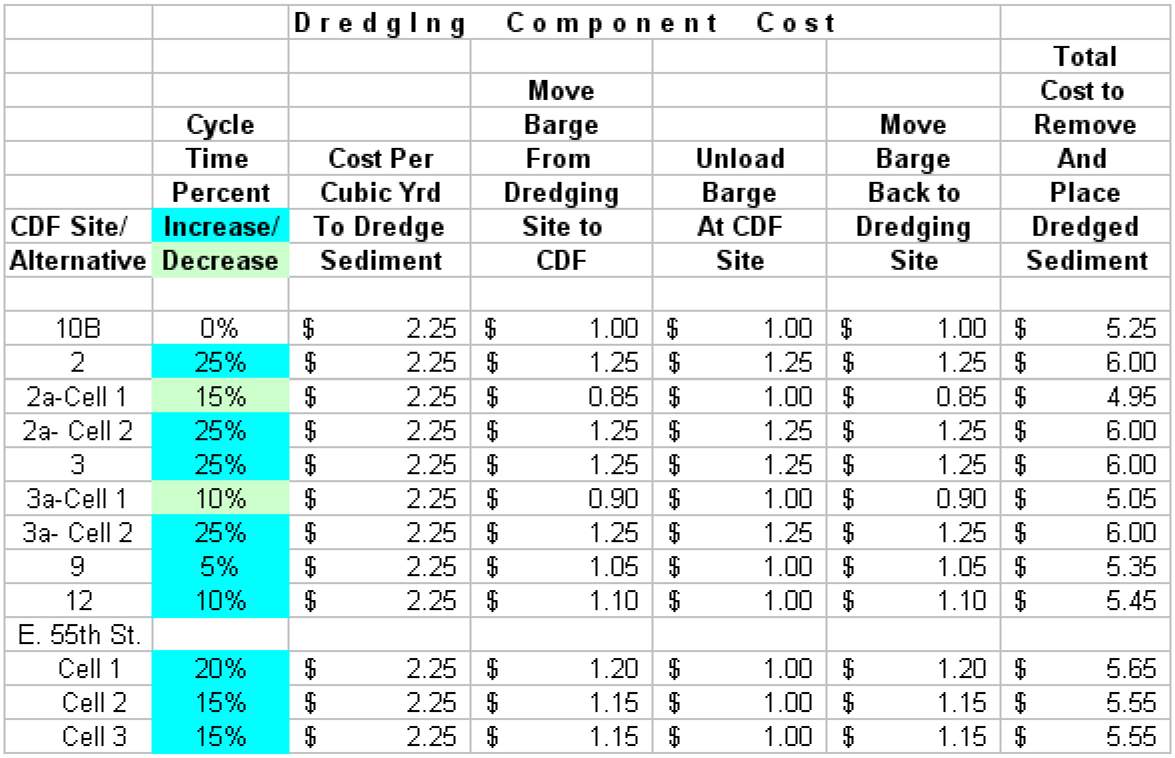
3. Dredging Costs Per Dredging Event- By Disposal Location The Project Management Team has provided the variable cost per cubic yard for placement of sediment at the current CDF site 10B $5.25. These costs were then adjusted to reflect the increase/decrease in cycle times that would occur when using other CDFs. Table 7 summarizes these dredging costs per cubic yard by CDF site. Dredging costs per cubic yard for CDFs located outside the harbor breakwaters were higher than CDF 10B dredging costs. This is due to the increased wind and wave activity that would be encountered during dredging operations which would increase round trip dredge cycling times.

Table 6. Cleveland Harbor Sediment Dredging Schedule-2009- 2028



Project Evaluation Period			2009-2028		
Calander Year	Project Year	Federal Sediment Placed In CDF	Non-Federal Sediment Placed In CDF	Total Cubic Yards Placed in CDF	
2008		225,000	25,000	250,000	Dike 10B
2009	1	225,000	25,000	250,000	Dike 12
2010	2	225,000	25,000	250,000	2.0 Years
2011	3	225,000	25,000	250,000	Dike 9
2012	4	225,000	25,000	250,000	2 Years
2013	5	225,000	25,000	250,000	Dike 12
2014	6	362,000	48,400	410,400	2.0 Years
2015	7	362,000	48,400	410,400	New
2016	8	362,000	48,400	410,400	Harbor
2017	9	362,000	48,400	410,400	Sediment
2018	10	362,000	48,400	410,400	Disposal
2019	11	362,000	48,400	410,400	Site
2020	12	362,000	48,400	410,400	
2021	13	293,500	36,700	330,200	14 years
2022	14	293,500	36,700	330,200	Of
2023	15	293,500	36,700	330,200	Dredging
2024	16	293,500	36,700	330,200	Cubic
2025	17	293,500	36,700	330,200	Yards
2026	18	293,500	36,700	330,200	Placed
2027	19	293,500	36,700	330,200	5,104,000
2028	20	293,500	36,700	330,200	
		---------------	---------------	---------------	
Evaluation Period Disposal		6,007,000	757,400	6,764,400	
Annual Disposal		**300,350**	**37,870**	**338,220**	

Table 7 Dredging Costs Per Cubic Yard By Disposal Site



		Dredging Component Cost				
CDF Site/ Alternative	Cycle Time Percent Increase/ Decrease	Cost Per Cubic Yrd To Dredge Sediment	Move Barge From Dredging Site to CDF	Unload Barge At CDF Site	Move Barge Back to Dredging Site	Total Cost to Remove And Place Dredged Sediment
10B	0%	$ 2.25	$ 1.00	$ 1.00	$ 1.00	$ 5.25
2	25%	$ 2.25	$ 1.25	$ 1.25	$ 1.25	$ 6.00
2a-Cell 1	15%	$ 2.25	$ 0.85	$ 1.00	$ 0.85	$ 4.95
2a- Cell 2	25%	$ 2.25	$ 1.25	$ 1.25	$ 1.25	$ 6.00
3	25%	$ 2.25	$ 1.25	$ 1.25	$ 1.25	$ 6.00
3a-Cell 1	10%	$ 2.25	$ 0.90	$ 1.00	$ 0.90	$ 5.05
3a- Cell 2	25%	$ 2.25	$ 1.25	$ 1.25	$ 1.25	$ 6.00
9	5%	$ 2.25	$ 1.05	$ 1.00	$ 1.05	$ 5.35
12	10%	$ 2.25	$ 1.10	$ 1.00	$ 1.10	$ 5.45
E. 55th St.						
Cell 1	20%	$ 2.25	$ 1.20	$ 1.00	$ 1.20	$ 5.65
Cell 2	15%	$ 2.25	$ 1.15	$ 1.00	$ 1.15	$ 5.55
Cell 3	15%	$ 2.25	$ 1.15	$ 1.00	$ 1.15	$ 5.55

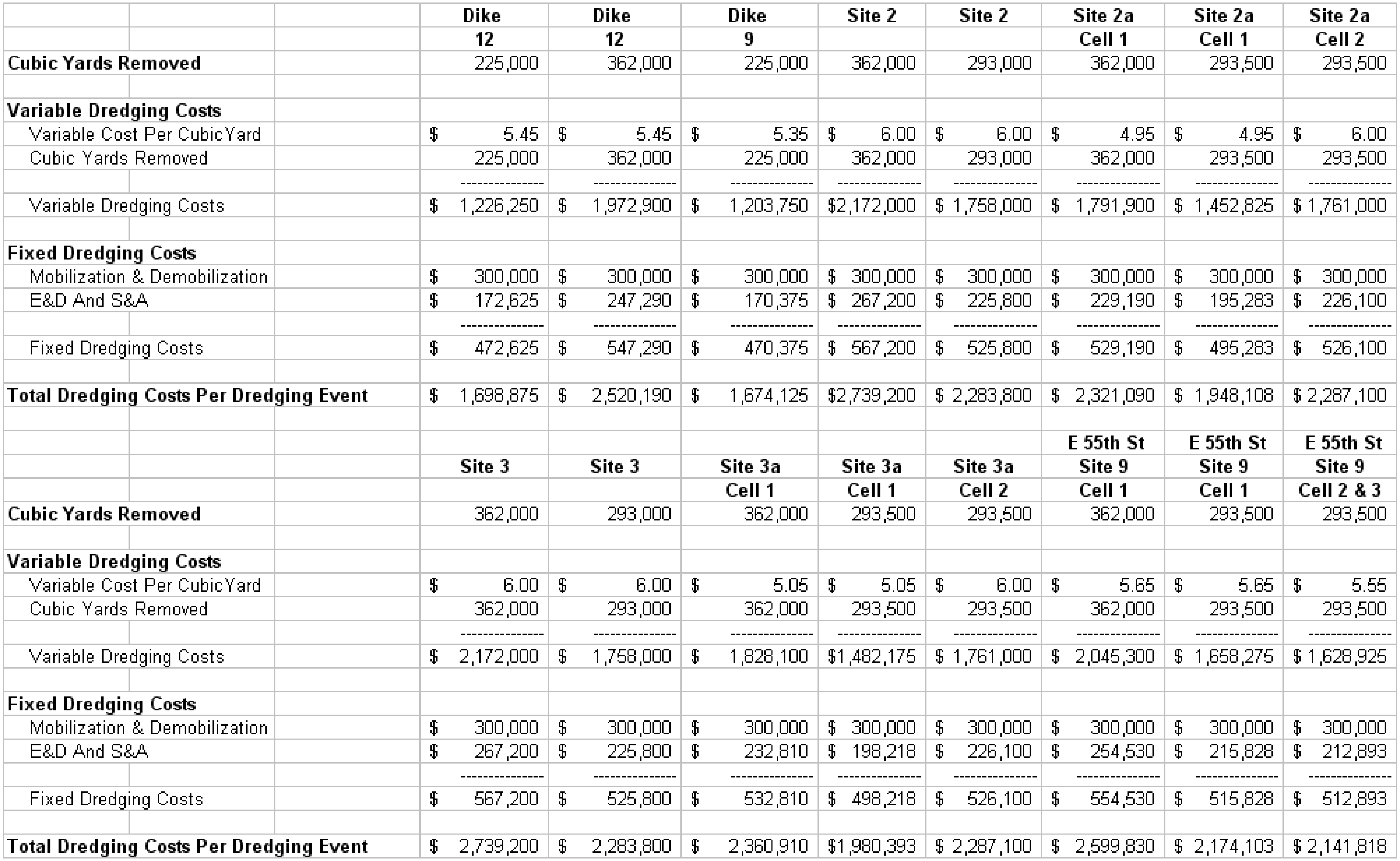
These dredging costs per cubic yard by disposal site were then used with cubic yards removed per year, to develop variable dredging costs per dredging event by disposal location. Added to these variable costs were fixed costs consisting of mobilization and demobilization costs, Engineering and Design (E&D) and Supervision and Administration (S&A). Table 8 provides a summary of dredging costs per cycle by cubic yards removed by disposal location.

The cost of dredging at any one time is a function of the dredging event's variable and fixed costs. The variable costs of dredging are the product of an estimated cost per cubic yard of dredging by disposal site (Table 7), times the number of cubic yards removed that year (Table 6). Fixed costs consist of the mobilization/demobilization cost for the dredge, and the cost the District incurs in engineering, administering and supervising the entire dredging project each time the harbor is dredged. For Cleveland Harbor the mobilization/demobilization cost is $300,000. Fixed costs per dredging event (Engineering and Design, Supervision and Administration)) are set to be $50,000 plus 10 percent of variable costs.

For example, dredging costs associated with removing 225,000 cubic yards of sediment in 2009 and placing it in CDF 12 is $1,698,875. These costs consist of variable dredging costs ($5.45 per cubic yard x 225,000 cubic yards =$1,226,150) and fixed dredging costs ($300,000 for mobilization + $50,000+ 10 percent x $1,226,250=$472,625).

4. Time Steam Of Annual Dredging Costs By Alternative The cyclical dredging costs presented in Table 8, in conjunction with the dredging schedule presented in Table 6, were used to develop a time stream of dredging costs associated with each of the plans being evaluated in detail over the project evaluation period: 2009-2028. Table 9 presents the time stream of dredging costs associated with each plan being evaluated. This time stream of dredging costs was used as inputs to calculating average annual implementation costs associated with the plans evaluated. Dredging costs are just one of many components that make up implementation costs associated with each alternative.

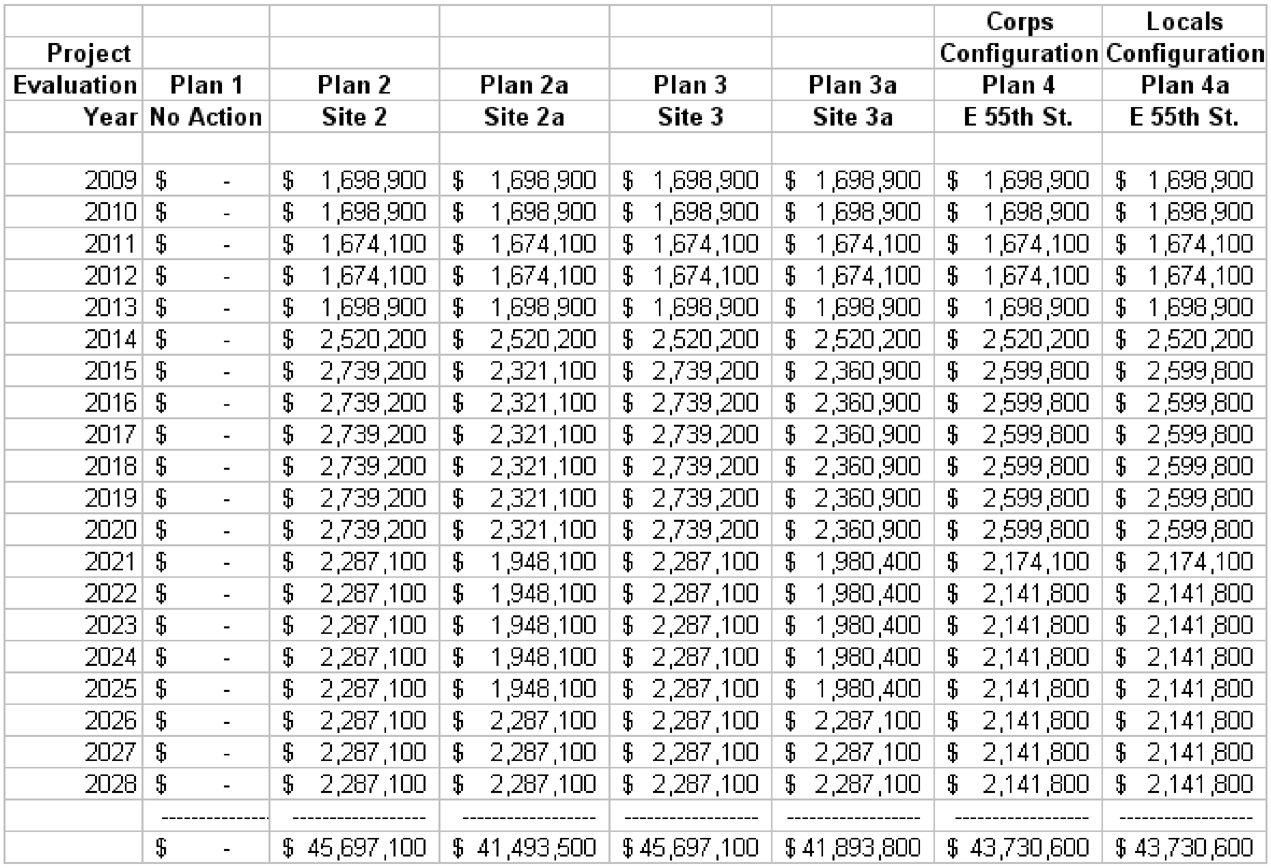
Table 8 Summary of Dredging Costs Per Cycle, By Placement Location.



	Dike 12	Dike 12	Dike 9	Site 2	Site 2	Site 2a Cell 1	Site 2a Cell 1	Site 2a Cell 2
Cubic Yards Removed	225,000	362,000	225,000	362,000	293,000	362,000	293,500	293,500
Variable Dredging Costs								
Variable Cost Per CubicYard	$ 5.45	$ 5.45	$ 5.35	$ 6.00	$ 6.00	$ 4.95	$ 4.95	$ 6.00
Cubic Yards Removed	225,000	362,000	225,000	362,000	293,000	362,000	293,500	293,500
	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------
Variable Dredging Costs	$ 1,226,250	$ 1,972,900	$ 1,203,750	$2,172,000	$ 1,758,000	$ 1,791,900	$ 1,452,825	$ 1,761,000
Fixed Dredging Costs								
Mobilization & Demobilization	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000
E&D And S&A	$ 172,625	$ 247,290	$ 170,375	$ 267,200	$ 225,800	$ 229,190	$ 195,283	$ 226,100
	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------
Fixed Dredging Costs	$ 472,625	$ 547,290	$ 470,375	$ 567,200	$ 525,800	$ 529,190	$ 495,283	$ 526,100
Total Dredging Costs Per Dredging Event	$ 1,698,875	$ 2,520,190	$ 1,674,125	$2,739,200	$ 2,283,800	$ 2,321,090	$ 1,948,108	$ 2,287,100

	Site 3	Site 3	Site 3a Cell 1	Site 3a Cell 1	Site 3a Cell 2	E 55th St Site 9 Cell 1	E 55th St Site 9 Cell 1	E 55th St Site 9 Cell 2 & 3
Cubic Yards Removed	362,000	293,000	362,000	293,500	293,500	362,000	293,500	293,500
Variable Dredging Costs								
Variable Cost Per CubicYard	$ 6.00	$ 6.00	$ 5.05	$ 5.05	$ 6.00	$ 5.65	$ 5.65	$ 5.55
Cubic Yards Removed	362,000	293,000	362,000	293,500	293,500	362,000	293,500	293,500
	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------
Variable Dredging Costs	$ 2,172,000	$ 1,758,000	$ 1,828,100	$1,482,175	$ 1,761,000	$ 2,045,300	$ 1,658,275	$ 1,628,925
Fixed Dredging Costs								
Mobilization & Demobilization	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000
E&D And S&A	$ 267,200	$ 225,800	$ 232,810	$ 198,218	$ 226,100	$ 254,530	$ 215,828	$ 212,893
	--------------	--------------	--------------	--------------	--------------	--------------	--------------	--------------
Fixed Dredging Costs	$ 567,200	$ 525,800	$ 532,810	$ 498,218	$ 526,100	$ 554,530	$ 515,828	$ 512,893
Total Dredging Costs Per Dredging Event	$ 2,739,200	$ 2,283,800	$ 2,360,910	$1,980,393	$ 2,287,100	$ 2,599,830	$ 2,174,103	$ 2,141,818

Table 9 Timestream Of Dredging Costs Per Year By Plan



						Corps	Locals
Project						Configuration	Configuration
Evaluation	Plan 1	Plan 2	Plan 2a	Plan 3	Plan 3a	Plan 4	Plan 4a
Year	No Action	Site 2	Site 2a	Site 3	Site 3a	E 55th St.	E 55th St.
2009	$ -	$ 1,698,900	$ 1,698,900	$ 1,698,900	$ 1,698,900	$ 1,698,900	$ 1,698,900
2010	$ -	$ 1,698,900	$ 1,698,900	$ 1,698,900	$ 1,698,900	$ 1,698,900	$ 1,698,900
2011	$ -	$ 1,674,100	$ 1,674,100	$ 1,674,100	$ 1,674,100	$ 1,674,100	$ 1,674,100
2012	$ -	$ 1,674,100	$ 1,674,100	$ 1,674,100	$ 1,674,100	$ 1,674,100	$ 1,674,100
2013	$ -	$ 1,698,900	$ 1,698,900	$ 1,698,900	$ 1,698,900	$ 1,698,900	$ 1,698,900
2014	$ -	$ 2,520,200	$ 2,520,200	$ 2,520,200	$ 2,520,200	$ 2,520,200	$ 2,520,200
2015	$ -	$ 2,739,200	$ 2,321,100	$ 2,739,200	$ 2,360,900	$ 2,599,800	$ 2,599,800
2016	$ -	$ 2,739,200	$ 2,321,100	$ 2,739,200	$ 2,360,900	$ 2,599,800	$ 2,599,800
2017	$ -	$ 2,739,200	$ 2,321,100	$ 2,739,200	$ 2,360,900	$ 2,599,800	$ 2,599,800
2018	$ -	$ 2,739,200	$ 2,321,100	$ 2,739,200	$ 2,360,900	$ 2,599,800	$ 2,599,800
2019	$ -	$ 2,739,200	$ 2,321,100	$ 2,739,200	$ 2,360,900	$ 2,599,800	$ 2,599,800
2020	$ -	$ 2,739,200	$ 2,321,100	$ 2,739,200	$ 2,360,900	$ 2,599,800	$ 2,599,800
2021	$ -	$ 2,287,100	$ 1,948,100	$ 2,287,100	$ 1,980,400	$ 2,174,100	$ 2,174,100
2022	$ -	$ 2,287,100	$ 1,948,100	$ 2,287,100	$ 1,980,400	$ 2,141,800	$ 2,141,800
2023	$ -	$ 2,287,100	$ 1,948,100	$ 2,287,100	$ 1,980,400	$ 2,141,800	$ 2,141,800
2024	$ -	$ 2,287,100	$ 1,948,100	$ 2,287,100	$ 1,980,400	$ 2,141,800	$ 2,141,800
2025	$ -	$ 2,287,100	$ 1,948,100	$ 2,287,100	$ 1,980,400	$ 2,141,800	$ 2,141,800
2026	$ -	$ 2,287,100	$ 2,287,100	$ 2,287,100	$ 2,287,100	$ 2,141,800	$ 2,141,800
2027	$ -	$ 2,287,100	$ 2,287,100	$ 2,287,100	$ 2,287,100	$ 2,141,800	$ 2,141,800
2028	$ -	$ 2,287,100	$ 2,287,100	$ 2,287,100	$ 2,287,100	$ 2,141,800	$ 2,141,800
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	$ -	$ 45,697,100	$ 41,493,500	$ 45,697,100	$ 41,893,800	$ 43,730,600	$ 43,730,600

IV. DEVELOPMENT OF PLAN AVERAGE ANNUAL COSTS

Section III described the alternative plans that would be evaluated in detail, and identified the year when various major expenditures would take place over the 20 year planning evaluation period. These major expenditures included dredging costs, implementing the FMP, and new disposal site implementation costs (real estate, land costs, CDF engineering and design, plans and specs, construction costs, etc) and fish habitat development. Other project construction and report related costs were identified (i.e. USFWS and NEPA report costs). "Other Recurring Costs" were also identified as well as the frequency of their occurrence. "Other Recurring Costs" include such items as sediment consolidation practices, harbor facility condition inspections/facility surveys, channel soundings, sediment sampling, periodic performance of baseline environmental, economic, and real estate studies, and active solicitation of sediment recycling and beneficial use projects.

Plan costs were developed for each year of the 20 year project evaluation period for each plan under with project conditions. These expenditure time streams are provided in Table 10 for each of the alternative Plans evaluated.

These time streams of costs were then brought back to their present worth values using the Federal discount rate of 4.625 percent. The Plan Evaluation Period for this analysis is 20 years, starting in 2009 and ending in 2028. Table 11 provides a summary of this procedure. These present worth values in Table 11, for the various plans, represent an estimate of Project First Costs. Project First Costs include Engineering and Design, Supervision and Administration and Land costs by Plan. However, since the land is acquired under navigational servitude, there are no Land Acquisition Costs associated with Plans 2, 2a, 3 or 3a. Nominal real estate costs are associated with Plans 4 and 4a, which involve 1-2 acres of land needed for raw material staging and fish habitat development costs. Interest during construction was added to first costs to arrive at investment costs. However, since benefits accrue immediately, there are no costs for interest during construction). Total investment costs were converted to an average annual basis using the water resources Federal discount rate of 4.625 percent, and a 20 year project life. Annual maintenance costs were calculated as a percentage of contractors earnings and contingencies. Annual maintenance costs were added to average annualized investment costs to arrive at plan average annual costs (Table 12).

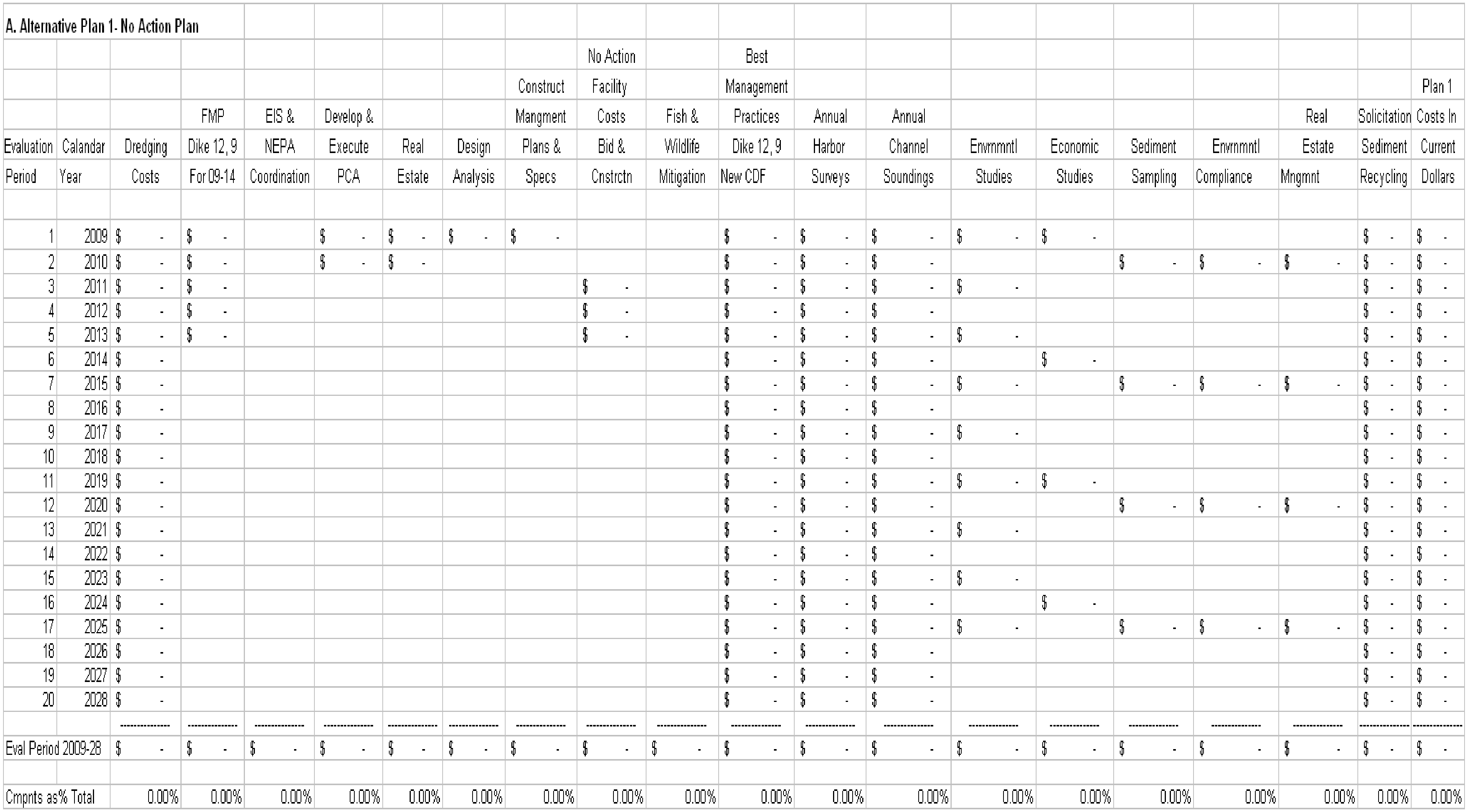
V. DEVELOPMENT OF PLAN AVERAGE ANNUAL BENEFITS

Benefits for this evaluation are the commercial navigation transportation cost increases avoided, by continuing to maintain the channels at the harbor. Maintained channel depths at Cleveland Harbor are 28 feet LWD in the outer harbor and 23 feet LWD on the Cuyahoga River. The difference in vessel transportation costs associated with maintaining current harbor depths (With Project Condition[WP]) and vessel transportation costs associated with discontinuing harbor dredging (Without Project Condition[WOP]), over a 20 year period, are the benefits associated with continuing to maintain the harbor.

The increase in vessel transportation costs under the WOP condition is a function of the harbors shoaling rate. Shoaling rates in Great Lakes harbors are highly variable over time. The general pattern is for a shoal to develop at the protected side of an unattached breakwater situated in the open waters of a Great Lake that shelters the entrance channel to a riverine harbor. The shoaling rate tends to increase as one progresses upstream along a channelized river channel. Shoaling at Cleveland Harbor follows this general pattern. Shoaling rates at Cleveland harbor vary between the Outer Harbor (.2 of a foot per year) and the Cuyahoga/Old River Channels (1-3 feet per year). More critical is the fact that shoaling upstream, especially in the Cuyahoga River Channel in vicinity of the Arcelor/Mittal Steel dock, is more rapid. Shoaling in this area can be between 3 and 6 feet per year. The shoaling rate will impact the rate of increase in vessel transportation costs under the Without Project condition, when harbor channels are allowed to shoal up

Table 10 - Time Stream of Plan Costs

Alternative Plan 1- No Action



A. Alternative Plan 1- No Action Plan																				
Evaluation Period	Calandar Year	Dredging Costs	FMP Dike 12, 9 For 09-14	EIS & NEPA Coordination	Develop & Execute PCA	Real Estate	Design Analysis	Construct Mangment Plans & Specs	No Action Facility Costs Bid & Cnstrctn	Fish & Wildlife Mitigation	Best Management Practices Dike 12, 9 New CDF	Annual Harbor Surveys	Annual Channel Soundings	Envrnmntl Studies	Economic Studies	Sediment Sampling	Envrnmntl Compliance	Real Estate Mngmnt	Solicitation Sediment Recycling	Plan 1 Costs In Current Dollars
1	2009	$ -	$ -		$ -	$ -	$ -	$ -			$ -	$ -	$ -	$ -	$ -				$ -	$ -
2	2010	$ -	$ -		$ -	$ -					$ -	$ -	$ -			$ -	$ -	$ -	$ -	$ -
3	2011	$ -	$ -						$ -		$ -	$ -	$ -	$ -					$ -	$ -
4	2012	$ -	$ -						$ -		$ -	$ -	$ -						$ -	$ -
5	2013	$ -	$ -						$ -		$ -	$ -	$ -	$ -					$ -	$ -
6	2014	$ -									$ -	$ -	$ -		$ -				$ -	$ -
7	2015	$ -									$ -	$ -	$ -	$ -		$ -	$ -	$ -	$ -	$ -
8	2016	$ -									$ -	$ -	$ -						$ -	$ -
9	2017	$ -									$ -	$ -	$ -	$ -					$ -	$ -
10	2018	$ -									$ -	$ -	$ -						$ -	$ -
11	2019	$ -									$ -	$ -	$ -	$ -	$ -				$ -	$ -
12	2020	$ -									$ -	$ -	$ -			$ -	$ -	$ -	$ -	$ -
13	2021	$ -									$ -	$ -	$ -	$ -					$ -	$ -
14	2022	$ -									$ -	$ -	$ -						$ -	$ -
15	2023	$ -									$ -	$ -	$ -	$ -					$ -	$ -
16	2024	$ -									$ -	$ -	$ -		$ -				$ -	$ -
17	2025	$ -									$ -	$ -	$ -	$ -		$ -	$ -	$ -	$ -	$ -
18	2026	$ -									$ -	$ -	$ -						$ -	$ -
19	2027	$ -									$ -	$ -	$ -						$ -	$ -
20	2028	$ -									$ -	$ -	$ -						$ -	$ -
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Eval Period 2009-28		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cmpnts as% Total		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Table 10 - Time Stream of Plan Costs-Continued

Alternative Plan 2- Fill Management Plan, New CDF At Site 2

B. Alternative Plan 2- Construction of CDF 2 & Management of Existing CDFS																				
		Plan, Design, Construct New Outer Harbor CDF																		
Evaluation Period	Calandar Year	Dredging Costs	FMP Dike 12, 9 For 09-14	EIS & NEPA Coordination	Develop & Execute PCA	Real Estate	Design Analysis	Construct Mangment Plans & Specs	CDF 2 Facility Costs Bid & Cnstrctn	Fish & Wildlife Mitigation	Best Management Practices Dike 12, 9 New CDF	Annual Harbor Surveys	Annual Channel Soundings	Envrnmntl Studies	Economic Studies	Sediment Sampling	Envrnmntl Compliance	Real Estate Mngmnt	Solicitation Sediment Recycling	Plan 2 Costs In Current Dollars
1	2009	$ 1,698,900	$ 2,409,000	$ 100,000	$ 30,000	$ -					$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 4,350,900
2	2010	$ 1,698,900	$ -	$ 50,000	$ 30,000	$ -	$ 3,711,700	$ 7,423,450			$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 13,082,050
3	2011	$ 1,674,100	$ 2,409,000				$ 3,711,700	$ 7,423,450			$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 15,296,250
4	2012	$ 1,674,100	$ -						$ 82,482,700		$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 84,224,800
5	2013	$ 1,698,900	$ 2,409,000						$ 82,482,700		$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 86,668,600
6	2014	$ 2,520,200							$ 82,482,600	$ 500,000	$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 85,605,800
7	2015	$ 2,739,200									$ 10,000	$ 5,000	$ 43,000	$ 10,000		$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,917,200
8	2016	$ 2,739,200									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,807,200
9	2017	$ 2,739,200									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,817,200
10	2018	$ 2,739,200									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,807,200
11	2019	$ 2,739,200									$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 2,852,200
12	2020	$ 2,739,200									$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,907,200
13	2021	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,365,100
14	2022	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,355,100
15	2023	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,365,100
16	2024	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 2,390,100
17	2025	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000	$ 10,000		$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,465,100
18	2026	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,355,100
19	2027	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,365,100
20	2028	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,355,100
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Eval Period 2009-28		$ 45,697,100	$ 7,227,000	$ 150,000	$ 60,000	$ -	$ 7,423,400	$ 14,846,900	$ 247,448,000	$ 500,000	$ 200,000	$ 100,000	$ 860,000	$ 100,000	$ 140,000	$ 340,000	$ 40,000	$ 20,000	$ 200,000	$ 325,352,400
Cmpnts as% Total		14.05%	2.22%	0.05%	0.02%	0.00%	2.28%	4.56%	76.06%	0.15%	0.06%	0.03%	0.26%	0.03%	0.04%	0.10%	0.01%	0.01%	0.06%	100.00%

Table 10 - Time Stream of Plan Costs-Continued

Alternative Plan 2a- Fill Management Plan, New CDF At Site 2a

B. Alternative Plan 2a- Construction of CDF 2a & Management of Existing CDFS																				
		Plan, Design, Construct New Outer Harbor CDF																		
Evaluation Period	Calandar Year	Dredging Costs	FMP Dike 12, 9 For 09-14	EIS & NEPA Coordination	Develop & Execute PCA	Real Estate	Design Analysis	Construct Mangment Plans & Specs	CDF 2a Facility Costs Bid & Cnstrctn	Fish & Wildlife Mitigation	Best Management Practices Dike 12, 9 New CDF	Annual Harbor Surveys	Annual Channel Soundings	Envrnmntl Studies	Economic Studies	Sediment Sampling	Envrnmntl Compliance	Real Estate Mngmnt	Solicitation Sediment Recycling	Plan 2a Costs In Current Dollars
1	2009	$ 1,698,900	$ 2,409,000	$ 100,000	$ 30,000	$ -					$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 4,350,900
2	2010	$ 1,698,900	$ -	$ 50,000	$ 30,000	$ -	$ 1,798,700	$ 3,597,400			$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 7,343,000
3	2011	$ 1,674,100	$ 2,409,000				$ 1,798,700	$ 3,597,400			$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 9,557,200
4	2012	$ 1,674,100	$ -						$ 39,971,000		$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 41,713,100
5	2013	$ 1,698,900	$ 2,409,000						$ 39,971,000		$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 44,156,900
6	2014	$ 2,520,200							$ 39,971,000	$ 250,000	$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 42,844,200
7	2015	$ 2,321,100									$ 10,000	$ 5,000	$ 43,000	$ 10,000		$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,499,100
8	2016	$ 2,321,100									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,389,100
9	2017	$ 2,321,100				$ -					$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,399,100
10	2018	$ 2,321,100				$ -	$ 2,187,000	$ 4,374,000			$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 8,950,100
11	2019	$ 2,321,100					$ 2,187,000	$ 4,374,000			$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 8,995,100
12	2020	$ 2,321,100							$ 48,599,700		$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 51,088,800
13	2021	$ 1,948,100							$ 48,599,700		$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 50,625,800
14	2022	$ 1,948,100							$ 48,599,600	$ 250,000	$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 50,865,700
15	2023	$ 1,948,100									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,026,100
16	2024	$ 1,948,100									$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 2,051,100
17	2025	$ 1,948,100									$ 10,000	$ 5,000	$ 43,000	$ 10,000		$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,126,100
18	2026	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,355,100
19	2027	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,365,100
20	2028	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,355,100
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Eval Period 2009-28		$ 41,493,500	$ 7,227,000	$ 150,000	$ 60,000	$ -	$ 7,971,400	$ 15,942,800	$ 265,712,000	$ 500,000	$ 200,000	$ 100,000	$ 860,000	$ 100,000	$ 140,000	$ 340,000	$ 40,000	$ 20,000	$ 200,000	$ 341,056,700
Cmpnts as% Total		12.17%	2.12%	0.04%	0.02%	0.00%	2.34%	4.67%	77.91%	0.15%	0.06%	0.03%	0.25%	0.03%	0.04%	0.10%	0.01%	0.01%	0.06%	100.00%

Table 10 - Time Stream of Plan Costs-Continued

Alternative Plan 3- Fill Management Plan, New CDF At Site 3

C. Alternative Plan 3- Construction of CDF 3 & Management of Existing CDFS																				
		Plan, Design, Construct New Outer Harbor CDF																		
Evaluation Period	Calandar Year	Dredging Costs	FMP Dike 12, 9 For 09-14	EIS & NEPA Coordination	Develop & Execute PCA	Real Estate	Design Analysis	Construct Mangment Plans & Specs	CDF 3 Facility Costs Bid & Cnstrctn	Fish & Wildlife Mitigation	Best Management Practices Dike 12, 9 New CDF	Annual Harbor Surveys	Annual Channel Soundings	Envrnmntl Studies	Economic Studies	Sediment Sampling	Envrnmntl Compliance	Real Estate Mngmnt	Solicitation Sediment Recycling	Plan 3 Costs In Current Dollars
1	2009	$ 1,698,900	$ 2,409,000	$ 100,000	$ 30,000	$ -					$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 4,350,900
2	2010	$ 1,698,900	$ -	$ 50,000	$ 30,000	$ -	$ 3,085,400	$ 6,170,800			$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 11,203,100
3	2011	$ 1,674,100	$ 2,409,000				$ 3,085,400	$ 6,170,800			$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 13,417,300
4	2012	$ 1,674,100	$ -						$ 68,563,700		$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 70,305,800
5	2013	$ 1,698,900	$ 2,409,000						$ 68,563,700		$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 72,749,600
6	2014	$ 2,520,200							$ 68,563,600	$ 500,000	$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 71,686,800
7	2015	$ 2,739,200									$ 10,000	$ 5,000	$ 43,000	$ 10,000		$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,917,200
8	2016	$ 2,739,200									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,807,200
9	2017	$ 2,739,200									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,817,200
10	2018	$ 2,739,200									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,807,200
11	2019	$ 2,739,200									$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 2,852,200
12	2020	$ 2,739,200									$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,907,200
13	2021	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,365,100
14	2022	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,355,100
15	2023	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,365,100
16	2024	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 2,390,100
17	2025	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000	$ 10,000		$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,465,100
18	2026	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,355,100
19	2027	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,365,100
20	2028	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,355,100
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Eval Period 2009-28		$ 45,697,100	$ 7,227,000	$ 150,000	$ 60,000	$ -	$ 6,170,800	$ 12,341,600	$ 205,691,000	$ 500,000	$ 200,000	$ 100,000	$ 860,000	$ 100,000	$ 140,000	$ 340,000	$ 40,000	$ 20,000	$ 200,000	$ 279,837,500
Cmpnts as% Total		16.33%	2.58%	0.05%	0.02%	0.00%	2.21%	4.41%	73.50%	0.18%	0.07%	0.04%	0.31%	0.04%	0.05%	0.12%	0.01%	0.01%	0.07%	100.00%

Table 10 - Time Stream of Plan Costs-Continued

Alternative Plan 3a- Fill Management Plan, New CDF At Site 3a

C. Alternative Plan 3a- Construction of CDF 3a & Management of Existing CDFS																				
									CDF 3a		Best									
		Plan, Design, Construct New Outer Harbor CDF						Construct	Facility		Management									Plan 3a
			FMP	EIS &	Develop &			Mangment	Costs	Fish &	Practices	Annual	Annual					Real	Solicitation	Costs In
Evaluation	Calandar	Dredging	Dike 12, 9	NEPA	Execute	Real	Design	Plans &	Bid &	Wildlife	Dike 12, 9	Harbor	Channel	Envmmntl	Economic	Sediment	Envmmntl	Estate	Sediment	Current
Period	Year	Costs	For 09-14	Coordination	PCA	Estate	Analysis	Specs	Cnstrctn	Mitigation	New CDF	Surveys	Soundings	Studies	Studies	Sampling	Compliance	Mngmnt	Recycling	Dollars
1	2009	$ 1,698,900	$ 2,409,000	$ 100,000	$ 30,000	$ -					$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 4,350,900
2	2010	$ 1,698,900	$ -	$ 50,000	$ 30,000	$ -	$ 2,081,850	$ 4,163,650			$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 8,192,400
3	2011	$ 1,674,100	$ 2,409,000				$ 2,081,850	$ 4,163,650			$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 10,406,600
4	2012	$ 1,674,100	$ -						$ 46,263,000		$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 48,005,100
5	2013	$ 1,698,900	$ 2,409,000						$ 46,263,000		$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 50,448,900
6	2014	$ 2,520,200				$ -			$ 46,263,000	$ 250,000	$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 49,136,200
7	2015	$ 2,360,900				$ -	$ 3,023,300	$ 6,046,500			$ 10,000	$ 5,000	$ 43,000	$ 10,000		$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 11,608,700
8	2016	$ 2,360,900					$ 3,023,300	$ 6,046,500			$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 11,498,700
9	2017	$ 2,360,900							$ 67,183,300		$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 69,622,200
10	2018	$ 2,360,900							$ 67,183,300		$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 69,612,200
11	2019	$ 2,360,900							$ 67,183,400	$ 250,000	$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 69,907,300
12	2020	$ 2,360,900									$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,528,900
13	2021	$ 1,980,400									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,058,400
14	2022	$ 1,980,400									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,048,400
15	2023	$ 1,980,400									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,058,400
16	2024	$ 1,980,400									$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 2,083,400
17	2025	$ 1,980,400									$ 10,000	$ 5,000	$ 43,000	$ 10,000		$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,158,400
18	2026	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,355,100
19	2027	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,365,100
20	2028	$ 2,287,100									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,355,100
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Eval Period 2009-28		$ 41,893,800	$ 7,227,000	$ 150,000	$ 60,000	$ -	$ 10,210,300	$ 20,420,300	$ 340,339,000	$ 500,000	$ 200,000	$ 100,000	$ 860,000	$ 100,000	$ 140,000	$ 340,000	$ 40,000	$ 20,000	$ 200,000	$ 422,800,400
Cmpnts as% Total		9.91%	1.71%	0.04%	0.01%	0.00%	2.41%	4.83%	80.50%	0.12%	0.05%	0.02%	0.20%	0.02%	0.03%	0.08%	0.01%	0.00%	0.05%	100.00%

Table 10 - Time Stream of Plan Costs-Continued

Alternative Plan 4 Fill Management Plan, New CDF At Site 9-E 55th St. –Corps Configuration

D. Alternative Plan 4- Construction of CDF 9-E 55th St & Management of Existing CDFS- Corps Configuation BTBOC																				
			Plan, Design, Construct New Outer Harbor CDF																	
Evaluation Period	Calandar Year	Dredging Costs	FMP Dike 12, 9 For 09-14	EIS & NEPA Coordination	Develop & Execute PCA	Real Estate	Design Analysis	Construct Mangment Plans & Specs	CDF 4-E 55th St. Facility Costs Bid & Cnstrctn	Fish & Wildlife Mitigation	Best Management Practices Dike 12, 9 New CDF	Annual Harbor Surveys	Annual Channel Soundings	Envrnmntl Studies	Economic Studies	Sediment Sampling	Envrnmntl Compliance	Real Estate Mngmnt	Solicitation Sediment Recycling	Plan 4- E 55th Costs In Current Dollars
1	2009	$ 1,698,900	$ 2,409,000	$ 100,000	$ 30,000	$ 22,500					$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 4,373,400
2	2010	$ 1,698,900	$ -	$ 50,000	$ 30,000	$ 22,500	$ 1,656,750	$ 3,313,500			$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 6,939,650
3	2011	$ 1,674,100	$ 2,409,000				$ 1,656,750	$ 3,313,500			$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 9,131,350
4	2012	$ 1,674,100	$ -						$ 36,816,700		$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 38,558,800
5	2013	$ 1,698,900	$ 2,409,000						$ 36,816,700		$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 41,002,600
6	2014	$ 2,520,200							36,816,600	$ 166,700	$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 39,606,500
7	2015	$ 2,599,800									$ 10,000	$ 5,000	$ 43,000	$ 10,000		$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,777,800
8	2016	$ 2,599,800									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,667,800
9	2017	$ 2,599,800					$ 811,400	$ 1,622,800			$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 5,112,000
10	2018	$ 2,599,800					$ 811,400	$ 1,622,800			$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 5,102,000
11	2019	$ 2,599,800							$ 18,030,300		$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 20,743,100
12	2020	$ 2,599,800							$ 18,030,300		$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 20,798,100
13	2021	$ 2,174,100							$ 18,030,400	$ 166,700	$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 20,449,200
14	2022	$ 2,141,800					$ 1,100,800	$ 2,201,700			$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 5,512,300
15	2023	$ 2,141,800					$ 1,100,800	$ 2,201,700			$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 5,522,300
16	2024	$ 2,141,800							24462700		$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 26,707,500
17	2025	$ 2,141,800							$ 24,462,700		$ 10,000	$ 5,000	$ 43,000	$ 10,000		$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 26,782,500
18	2026	$ 2,141,800							$ 24,462,600	$ 166,600	$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 26,839,000
19	2027	$ 2,141,800									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,219,800
20	2028	$ 2,141,800									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,209,800
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Eval Period 2009-28		$ 43,730,600	$ 7,227,000	$ 150,000	$ 60,000	$ 45,000	$ 7,137,900	$ 14,276,000	$ 237,929,000	$ 500,000	$ 200,000	$ 100,000	$ 860,000	$ 100,000	$ 140,000	$ 340,000	$ 40,000	$ 20,000	$ 200,000	$ 313,055,500
Cmpnts as% Total		13.97%	2.31%	0.05%	0.02%	0.01%	2.28%	4.56%	76.00%	0.16%	0.06%	0.03%	0.27%	0.03%	0.04%	0.11%	0.01%	0.01%	0.06%	100.00%

Table 10 - Time Stream of Plan Costs-Continued

Alternative Plan 4a Fill Management Plan, New CDF At Site 9-E 55th St. –Locals Configuration

D. Alternative Plan 4a- Construction of CDF at E 55th St & Management of Existing CDFS- Local Configuration

			Plan, Design, Construct New Outer Harbor CDF																	
Evaluation Period	Calandar Year	Dredging Costs	FMP Dike 12, 9 For 09-14	EIS & NEPA Coordination	Develop & Execute PCA	Real Estate	Design Analysis	Construct Mangment Plans & Specs	CDF 5-E 55th St. Facility Costs Bid & Cnstrctn	Fish & Wildlife Mitigation	Best Management Practices Dike 12, 9 New CDF	Annual Harbor Surveys	Annual Channel Soundings	Envmmntl Studies	Economic Studies	Sediment Sampling	Envmmntl Compliance	Real Estate Mngmnt	Solicitation Sediment Recycling	Plan 4a- E 55th Costs In Current Dollars
1	2009	$ 1,698,900	$ 2,409,000	$ 100,000	$ 30,000	$ 22,500					$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 4,373,400
2	2010	$ 1,698,900	$ -	$ 50,000	$ 30,000	$ 22,500	$ 1,945,000	$ 3,890,000			$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 7,804,400
3	2011	$ 1,674,100	$ 2,409,000				$ 1,945,000	$ 3,890,000			$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 9,996,100
4	2012	$ 1,674,100	$ -						$ 43,222,300		$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 44,964,400
5	2013	$ 1,698,900	$ 2,409,000						$ 43,222,300		$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 47,408,200
6	2014	$ 2,520,200							43,222,400	$ 166,700	$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 46,012,300
7	2015	$ 2,599,800									$ 10,000	$ 5,000	$ 43,000	$ 10,000		$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,777,800
8	2016	$ 2,599,800									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,667,800
9	2017	$ 2,599,800					$ 907,700	$ 1,815,400			$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 5,400,900
10	2018	$ 2,599,800					$ 907,700	$ 1,815,400			$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 5,390,900
11	2019	$ 2,599,800							$ 20,171,000		$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 22,883,800
12	2020	$ 2,599,800							$ 20,171,000		$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 22,938,800
13	2021	$ 2,174,100							$ 20,171,000	$ 166,700	$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 22,589,800
14	2022	$ 2,141,800					$ 1,302,100	$ 2,604,200			$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 6,116,100
15	2023	$ 2,141,800					$ 1,302,100	$ 2,604,200			$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 6,126,100
16	2024	$ 2,141,800							$ 28,935,700		$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 31,180,500
17	2025	$ 2,141,800							$ 28,935,700		$ 10,000	$ 5,000	$ 43,000	$ 10,000		$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 31,255,500
18	2026	$ 2,141,800							$ 28,935,600	$ 166,600	$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 31,312,000
19	2027	$ 2,141,800									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,219,800
20	2028	$ 2,141,800									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,209,800
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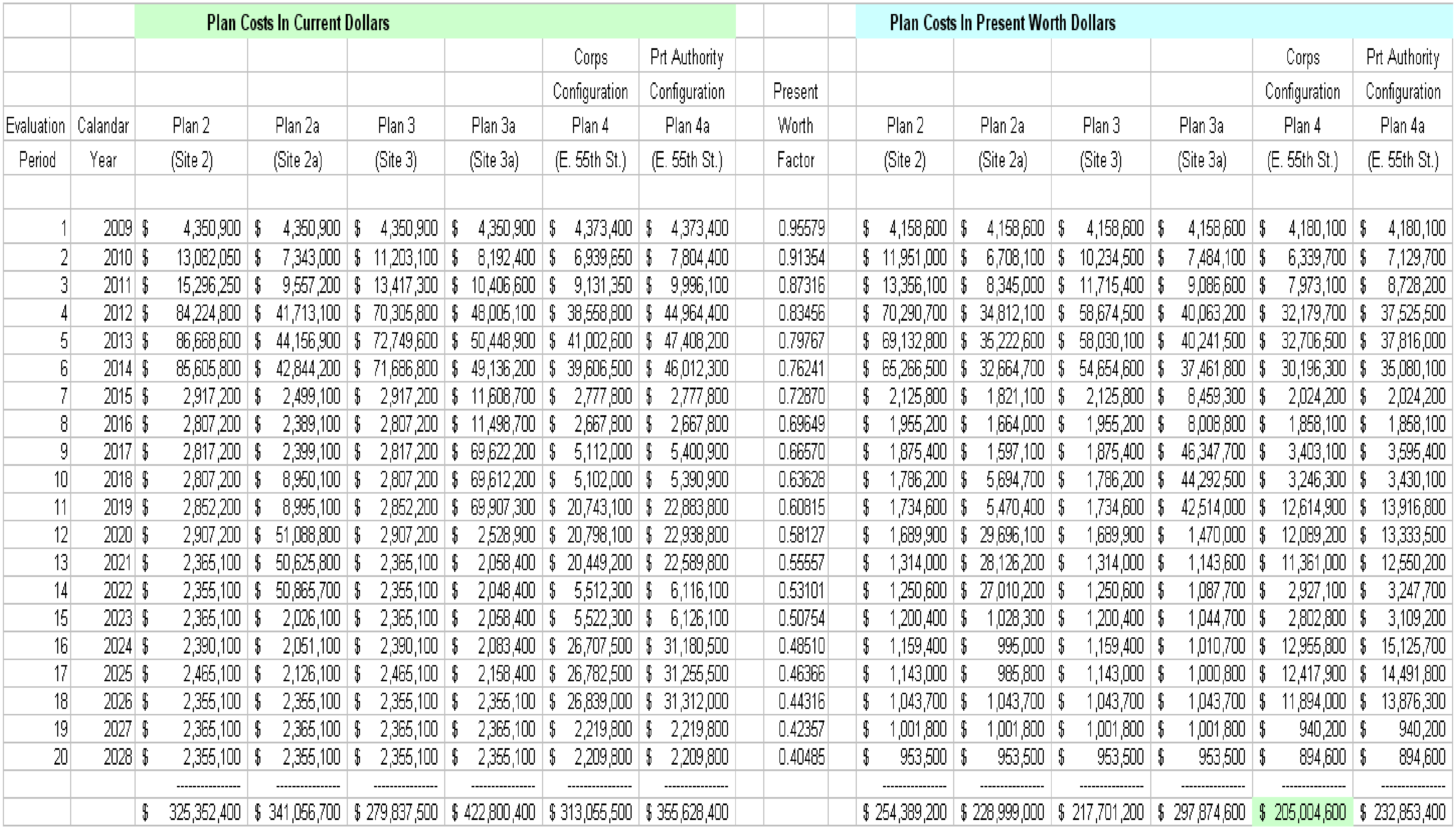
Eval Period 2009-28		$ 43,730,600	$ 7,227,000	$ 150,000	$ 60,000	$ 45,000	$ 8,309,600	$ 16,619,200	$ 276,987,000	$ 500,000	$ 200,000	$ 100,000	$ 860,000	$ 100,000	$ 140,000	$ 340,000	$ 40,000	$ 20,000	$ 200,000	$ 355,628,400
Cmpnts as% Total		12.30%	2.03%	0.04%	0.02%	0.01%	2.34%	4.67%	77.89%	0.14%	0.06%	0.03%	0.24%	0.03%	0.04%	0.10%	0.01%	0.01%	0.06%	100.00%

Table 11 Present Worth Of Plan Costs- Plan 1, 2, 2a, 3, 3a, 4, 4a



		Plan Costs In Current Dollars									Plan Costs In Present Worth Dollars					
						Corps	Prt Authority								Corps	Prt Authority
						Configuration	Configuration		Present						Configuration	Configuration
Evaluation	Calandar	Plan 2	Plan 2a	Plan 3	Plan 3a	Plan 4	Plan 4a		Worth		Plan 2	Plan 2a	Plan 3	Plan 3a	Plan 4	Plan 4a
Period	Year	(Site 2)	(Site 2a)	(Site 3)	(Site 3a)	(E. 55th St.)	(E. 55th St.)		Factor		(Site 2)	(Site 2a)	(Site 3)	(Site 3a)	(E. 55th St.)	(E. 55th St.)
1	2009	$ 4,350,900	$ 4,350,900	$ 4,350,900	$ 4,350,900	$ 4,373,400	$ 4,373,400		0.95579		$ 4,158,600	$ 4,158,600	$ 4,158,600	$ 4,158,600	$ 4,180,100	$ 4,180,100
2	2010	$ 13,082,050	$ 7,343,000	$ 11,203,100	$ 8,192,400	$ 6,939,650	$ 7,804,400		0.91354		$ 11,951,000	$ 6,708,100	$ 10,234,500	$ 7,484,100	$ 6,339,700	$ 7,129,700
3	2011	$ 15,296,250	$ 9,557,200	$ 13,417,300	$ 10,406,600	$ 9,131,350	$ 9,996,100		0.87316		$ 13,356,100	$ 8,345,000	$ 11,715,400	$ 9,086,600	$ 7,973,100	$ 8,728,200
4	2012	$ 84,224,800	$ 41,713,100	$ 70,305,800	$ 48,005,100	$ 38,558,800	$ 44,964,400		0.83456		$ 70,290,700	$ 34,812,100	$ 58,674,500	$ 40,063,200	$ 32,179,700	$ 37,525,500
5	2013	$ 86,668,600	$ 44,156,900	$ 72,749,600	$ 50,448,900	$ 41,002,600	$ 47,408,200		0.79767		$ 69,132,800	$ 35,222,600	$ 58,030,100	$ 40,241,500	$ 32,706,500	$ 37,816,000
6	2014	$ 85,605,800	$ 42,844,200	$ 71,686,800	$ 49,136,200	$ 39,606,500	$ 46,012,300		0.76241		$ 65,266,500	$ 32,664,700	$ 54,654,600	$ 37,461,800	$ 30,196,300	$ 35,080,100
7	2015	$ 2,917,200	$ 2,499,100	$ 2,917,200	$ 11,608,700	$ 2,777,800	$ 2,777,800		0.72870		$ 2,125,800	$ 1,821,100	$ 2,125,800	$ 8,459,300	$ 2,024,200	$ 2,024,200
8	2016	$ 2,807,200	$ 2,389,100	$ 2,807,200	$ 11,498,700	$ 2,667,800	$ 2,667,800		0.69649		$ 1,955,200	$ 1,664,000	$ 1,955,200	$ 8,008,800	$ 1,858,100	$ 1,858,100
9	2017	$ 2,817,200	$ 2,399,100	$ 2,817,200	$ 69,622,200	$ 5,112,000	$ 5,400,900		0.66570		$ 1,875,400	$ 1,597,100	$ 1,875,400	$ 46,347,700	$ 3,403,100	$ 3,595,400
10	2018	$ 2,807,200	$ 8,950,100	$ 2,807,200	$ 69,612,200	$ 5,102,000	$ 5,390,900		0.63628		$ 1,786,200	$ 5,694,700	$ 1,786,200	$ 44,292,500	$ 3,246,300	$ 3,430,100
11	2019	$ 2,852,200	$ 8,995,100	$ 2,852,200	$ 69,907,300	$ 20,743,100	$ 22,883,800		0.60815		$ 1,734,600	$ 5,470,400	$ 1,734,600	$ 42,514,000	$ 12,614,900	$ 13,916,800
12	2020	$ 2,907,200	$ 51,088,800	$ 2,907,200	$ 2,528,900	$ 20,798,100	$ 22,938,800		0.58127		$ 1,689,900	$ 29,696,100	$ 1,689,900	$ 1,470,000	$ 12,089,200	$ 13,333,500
13	2021	$ 2,365,100	$ 50,625,800	$ 2,365,100	$ 2,058,400	$ 20,449,200	$ 22,589,800		0.55557		$ 1,314,000	$ 28,126,200	$ 1,314,000	$ 1,143,600	$ 11,361,000	$ 12,550,200
14	2022	$ 2,355,100	$ 50,865,700	$ 2,355,100	$ 2,048,400	$ 5,512,300	$ 6,116,100		0.53101		$ 1,250,600	$ 27,010,200	$ 1,250,600	$ 1,087,700	$ 2,927,100	$ 3,247,700
15	2023	$ 2,365,100	$ 2,026,100	$ 2,365,100	$ 2,058,400	$ 5,522,300	$ 6,126,100		0.50754		$ 1,200,400	$ 1,028,300	$ 1,200,400	$ 1,044,700	$ 2,802,800	$ 3,109,200
16	2024	$ 2,390,100	$ 2,051,100	$ 2,390,100	$ 2,083,400	$ 26,707,500	$ 31,180,500		0.48510		$ 1,159,400	$ 995,000	$ 1,159,400	$ 1,010,700	$ 12,955,800	$ 15,125,700
17	2025	$ 2,465,100	$ 2,126,100	$ 2,465,100	$ 2,158,400	$ 26,782,500	$ 31,255,500		0.46366		$ 1,143,000	$ 985,800	$ 1,143,000	$ 1,000,800	$ 12,417,900	$ 14,491,800
18	2026	$ 2,355,100	$ 2,355,100	$ 2,355,100	$ 2,355,100	$ 26,839,000	$ 31,312,000		0.44316		$ 1,043,700	$ 1,043,700	$ 1,043,700	$ 1,043,700	$ 11,894,000	$ 13,876,300
19	2027	$ 2,365,100	$ 2,365,100	$ 2,365,100	$ 2,365,100	$ 2,219,800	$ 2,219,800		0.42357		$ 1,001,800	$ 1,001,800	$ 1,001,800	$ 1,001,800	$ 940,200	$ 940,200
20	2028	$ 2,355,100	$ 2,355,100	$ 2,355,100	$ 2,355,100	$ 2,209,800	$ 2,209,800		0.40485		$ 953,500	$ 953,500	$ 953,500	$ 953,500	$ 894,600	$ 894,600
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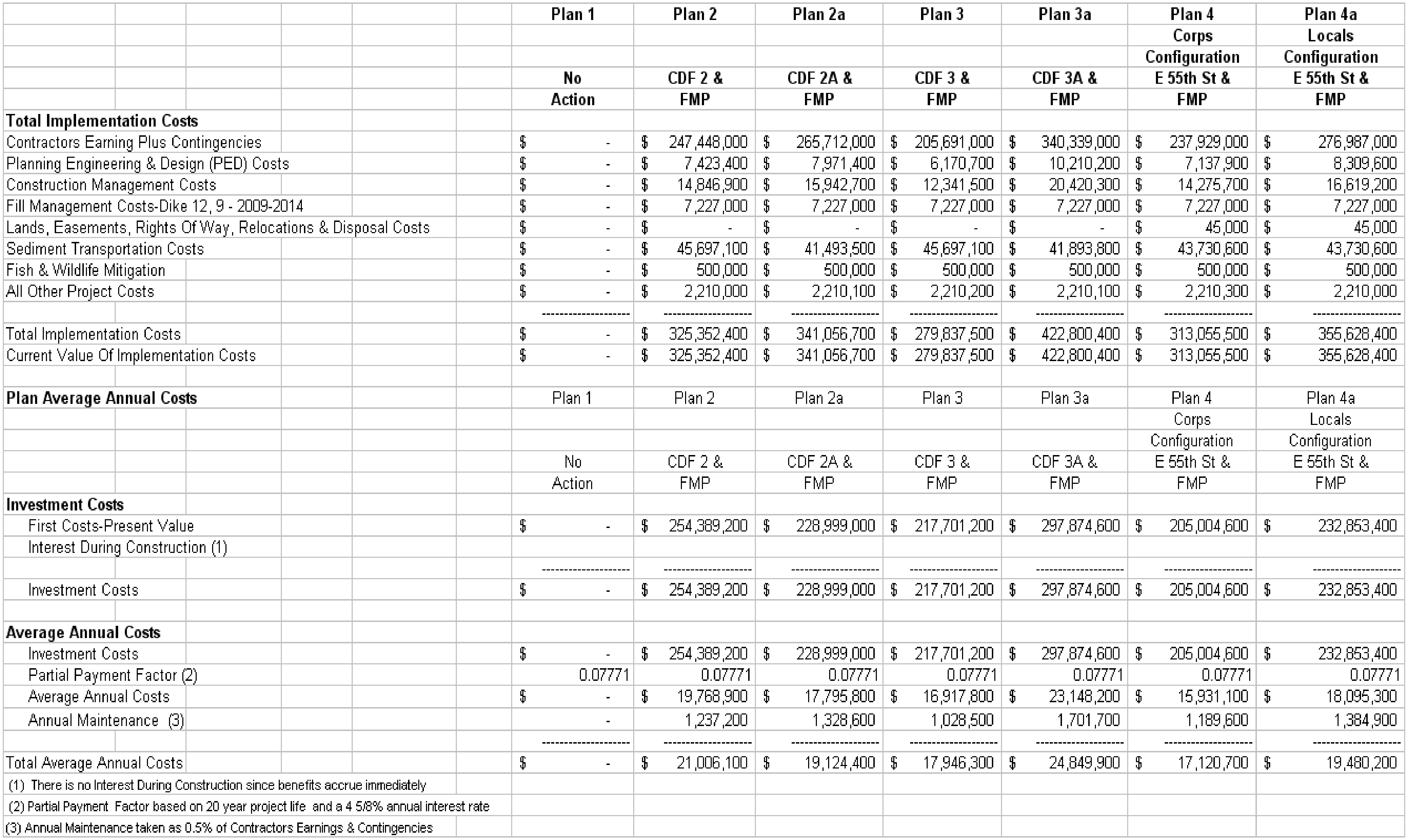
		$ 325,352,400	$ 341,056,700	$ 279,837,500	$ 422,800,400	$ 313,055,500	$ 355,628,400				$ 254,389,200	$ 228,999,000	$ 217,701,200	$ 297,874,600	$ 205,004,600	$ 232,853,400

Table 12- Plan Average Annual Costs



	Plan 1	Plan 2	Plan 2a	Plan 3	Plan 3a	Plan 4	Plan 4a
						Corps	Locals
						Configuration	Configuration
	No	CDF 2 &	CDF 2A &	CDF 3 &	CDF 3A &	E 55th St &	E 55th St &
	Action	FMP	FMP	FMP	FMP	FMP	FMP
Total Implementation Costs							
Contractors Earning Plus Contingencies	$ -	$ 247,448,000	$ 265,712,000	$ 205,691,000	$ 340,339,000	$ 237,929,000	$ 276,987,000
Planning Engineering & Design (PED) Costs	$ -	$ 7,423,400	$ 7,971,400	$ 6,170,700	$ 10,210,200	$ 7,137,900	$ 8,309,600
Construction Management Costs	$ -	$ 14,846,900	$ 15,942,700	$ 12,341,500	$ 20,420,300	$ 14,275,700	$ 16,619,200
Fill Management Costs-Dike 12, 9 - 2009-2014	$ -	$ 7,227,000	$ 7,227,000	$ 7,227,000	$ 7,227,000	$ 7,227,000	$ 7,227,000
Lands, Easements, Rights Of Way, Relocations & Disposal Costs	$ -	$ -	$ -	$ -	$ -	$ 45,000	$ 45,000
Sediment Transportation Costs	$ -	$ 45,697,100	$ 41,493,500	$ 45,697,100	$ 41,893,800	$ 43,730,600	$ 43,730,600
Fish & Wildlife Mitigation	$ -	$ 500,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000
All Other Project Costs	$ -	$ 2,210,000	$ 2,210,100	$ 2,210,200	$ 2,210,100	$ 2,210,300	$ 2,210,000
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Total Implementation Costs	$ -	$ 325,352,400	$ 341,056,700	$ 279,837,500	$ 422,800,400	$ 313,055,500	$ 355,628,400
Current Value Of Implementation Costs	$ -	$ 325,352,400	$ 341,056,700	$ 279,837,500	$ 422,800,400	$ 313,055,500	$ 355,628,400
Plan Average Annual Costs	Plan 1	Plan 2	Plan 2a	Plan 3	Plan 3a	Plan 4	Plan 4a
						Corps	Locals
						Configuration	Configuration
	No	CDF 2 &	CDF 2A &	CDF 3 &	CDF 3A &	E 55th St &	E 55th St &
	Action	FMP	FMP	FMP	FMP	FMP	FMP
Investment Costs							
First Costs-Present Value	$ -	$ 254,389,200	$ 228,999,000	$ 217,701,200	$ 297,874,600	$ 205,004,600	$ 232,853,400
Interest During Construction (1)							
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Investment Costs	$ -	$ 254,389,200	$ 228,999,000	$ 217,701,200	$ 297,874,600	$ 205,004,600	$ 232,853,400
Average Annual Costs							
Investment Costs	$ -	$ 254,389,200	$ 228,999,000	$ 217,701,200	$ 297,874,600	$ 205,004,600	$ 232,853,400
Partial Payment Factor (2)	0.07771	0.07771	0.07771	0.07771	0.07771	0.07771	0.07771
Average Annual Costs	$ -	$ 19,768,900	$ 17,795,800	$ 16,917,800	$ 23,148,200	$ 15,931,100	$ 18,095,300
Annual Maintenance (3)	-	1,237,200	1,328,600	1,028,500	1,701,700	1,189,600	1,384,900
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Total Average Annual Costs	$ -	$ 21,006,100	$ 19,124,400	$ 17,946,300	$ 24,849,900	$ 17,120,700	$ 19,480,200

(1) There is no Interest During Construction since benefits accrue immediately

(2) Partial Payment Factor based on 20 year project life and a 4 5/8% annual interest rate

(3) Annual Maintenance taken as 0.5% of Contractors Earnings & Contingencies

The Outer Harbor channels were allowed to decrease to 24 feet LWD, based on a .2 foot per year shoaling rate. The evaluation looked at two different shoaling rates on the Cuyahoga River: one foot per year and 2 feet per year. Channels were allowed to shoal up 6 feet and then remain at that depth for the remainder of the 20 year evaluation period. The Cuyahoga River channels equilibrium channel depth was assumed to be 17 feet. Transportation cost time streams were developed for a 20 year evaluation period based on these shoaling rates.

Part I of Appendix G contains an economic evaluation entitled "Cleveland Harbor Economic Viability Analysis." Table 2 of this Cleveland Harbor viability analysis provides the average annual vessel transportation costs associated with the WP Condition (continued maintenance of the harbors authorized channels of 28 feet in the outer Harbor and 23 feet on the Cuyahoga River). These average annual transportation costs are $75,222,000.

If dredging at Cleveland Harbor was to cease, due to lack of a suitable dredged material management plan, the channels would gradually fill in, and additional transportation costs would be incurred. Table 5 of Appendix G, "Cleveland Harbor Economic Viability Analysis", summarizes these WOP transportation costs, given the two different shoaling rate scenarios. WOP condition average annual transportation costs varied from $98,718,600 to $102,373,200.

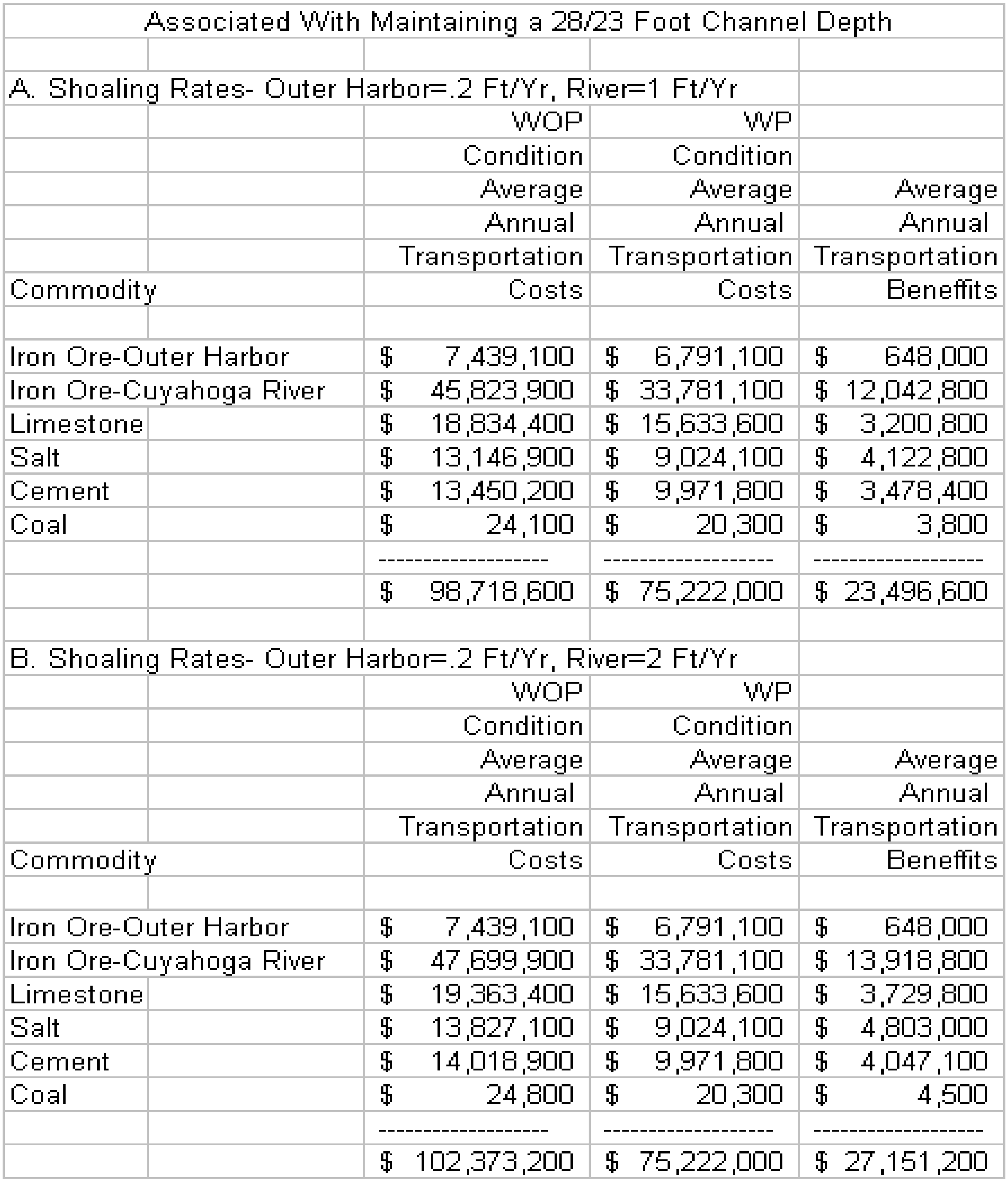
Alternative plan benefits are the difference between WOP and WP condition transportation costs (Table 13). Benefits associated with any one plan can range from $23,496,600 to $27,151,200. These benefits are considered conservative since shoaling at Arcelor/Mittal Steel docks can easily be 3 feet or greater in any one year. Greater detail on the calculation of WOP and WP condition average annual vessel transportation costs can be found in Appendix G: Part I, "Cleveland Harbor Economic Viability Analysis".

VI. PLAN BENEFIT COST RATIOS

Table 14 provides Benefit Cost Ratios by alternative plan. The benefit cost ratio is the ratio developed by dividing plan average annual benefits by plan average annual costs. Plan average annual benefits are the difference in average annual transportation costs between the WOP and WP condition. The average annual benefits used for the benefit to cost ratio analysis range from $23,496,600 to $27,151,200. (Note: Project benefit calculations for implementation of any Plan do not include land creation benefits. Although Plans 2-4a do create land, the lands created by most of the plans would not be available for usage until at least 2025, the 17th year of the project evaluation period. Only Plan 4 and 4a created land area located adjacent to the current shoreline. All other created lands can only be accessed by water. Consequently, land creation benefits were not included in the analysis.)

Alternative plan costs are the difference in harbor maintenance costs between the WP condition and the WOP condition. Since the WOP condition assumes all harbor maintenance expenditures cease in project year 1, the WOP condition harbor maintenance costs are zero. Thus alternative plan costs equal WP condition average annual costs. Average annual alternative plans costs are provided in Table 12.

Table 13- Cleveland Harbor Average Annual Harbor Transportation Cost Savings Associated With Maintaining a 28/23 Foot Channel Depth Costs



Associated With Maintaining a 28/23 Foot Channel Depth

A. Shoaling Rates- Outer Harbor=.2 Ft/Yr, River=1 Ft/Yr			
	WOP	WP	
	Condition	Condition	
	Average	Average	Average
	Annual	Annual	Annual
	Transportation	Transportation	Transportation
Commodity	Costs	Costs	Beneffits
Iron Ore-Outer Harbor	$ 7,439,100	$ 6,791,100	$ 648,000
Iron Ore-Cuyahoga River	$ 45,823,900	$ 33,781,100	$ 12,042,800
Limestone	$ 18,834,400	$ 15,633,600	$ 3,200,800
Salt	$ 13,146,900	$ 9,024,100	$ 4,122,800
Cement	$ 13,450,200	$ 9,971,800	$ 3,478,400
Coal	$ 24,100	$ 20,300	$ 3,800
	-------------------	-------------------	-------------------
	$ 98,718,600	$ 75,222,000	$ 23,496,600
B. Shoaling Rates- Outer Harbor=.2 Ft/Yr, River=2 Ft/Yr			
	WOP	WP	
	Condition	Condition	
	Average	Average	Average
	Annual	Annual	Annual
	Transportation	Transportation	Transportation
Commodity	Costs	Costs	Beneffits
Iron Ore-Outer Harbor	$ 7,439,100	$ 6,791,100	$ 648,000
Iron Ore-Cuyahoga River	$ 47,699,900	$ 33,781,100	$ 13,918,800
Limestone	$ 19,363,400	$ 15,633,600	$ 3,729,800
Salt	$ 13,827,100	$ 9,024,100	$ 4,803,000
Cement	$ 14,018,900	$ 9,971,800	$ 4,047,100
Coal	$ 24,800	$ 20,300	$ 4,500
	-------------------	-------------------	-------------------
	$ 102,373,200	$ 75,222,000	$ 27,151,200

Table 14 - Benefit to Cost Ratios by Plan

Benefit To Cost Ratios- 20 Year Project Evaluation Period- 4 58% Annual Interest Rate

A. Benefits Costs- Shoaling Rates- Outer Harbor=.2 Ft/Yr, Cuy/Old River=1.0 Ft/Yr

						NED Plan	
						Base Plan	
						Federal Standard	
	Plan 1	Plan 2	Plan 2a	Plan 3	Plan 3a	Plan 4	Plan 4a
						Corps	Locals
						Configuration	Configuration
	No	CDF 2 &	CDF 2A &	CDF 3 &	CDF 3A &	E 55th St &	E 55th St &
	Action	FMP	FMP	FMP	FMP	FMP	FMP
Benefits							
Without Project Transportation Costs	$ 98,718,600	$ 98,718,600	$ 98,718,600	$ 98,718,600	$ 98,718,600	$ 98,718,600	$ 98,718,600
With Project Transportation costs	$ 98,718,600	$ 75,222,000	$ 75,222,000	$ 75,222,000	$ 75,222,000	$ 75,222,000	$ 75,222,000
	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------
Plan Benefits	$ -	$ 23,496,600	$ 23,496,600	$ 23,496,600	$ 23,496,600	$ 23,496,600	$ 23,496,600
Costs							
With Project Harbor Maintenance Costs	$ -	$ 21,006,100	$ 19,124,400	$ 17,946,300	$ 24,849,900	$ 17,120,700	$ 19,480,200
Without Project Habor Maintenance Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------
Plan Costs	$ -	$ 21,006,100	$ 19,124,400	$ 17,946,300	$ 24,849,900	$ 17,120,700	$ 19,480,200
Plan Benefit Cost Ratios							
Plan Benefits	$ -	$ 23,496,600	$ 23,496,600	$ 23,496,600	$ 23,496,600	$ 23,496,600	$ 23,496,600
Plan Costs	$ -	$ 21,006,100	$ 19,124,400	$ 17,946,300	$ 24,849,900	$ 17,120,700	$ 19,480,200
Plan Benefit To Cost Ratio	0.00	1.12	1.23	1.31	0.95	1.37	1.21
Plan Net Benefits	$ -	$ 2,490,500	$ 4,372,200	$ 5,550,300	$ (1,353,300)	$ 6,375,900	$ 4,016,400

B. Benefits Costs- Shoaling Rates- Outer Harbor=.2 Ft/Yr, Cuy/Old River=2.0 Ft/Yr

						NED Plan	
						Base Plan	
						Federal Standard	
	Plan 1	Plan 2	Plan 2a	Plan 3	Plan 3a	Plan 4	Plan 4a
						Corps	Locals
						Configuration	Configuration
	No	CDF 2 &	CDF 2A &	CDF 3 &	CDF 3A &	E 55th St &	E 55th St &
	Action	FMP	FMP	FMP	FMP	FMP	FMP
Benefits							
Without Project Transportation Costs	$ 102,373,200	$ 102,373,200	$ 102,373,200	$ 102,373,200	$ 102,373,200	$ 102,373,200	$ 102,373,200
With Project Transportation costs	$ 102,373,200	$ 75,222,000	$ 75,222,000	$ 75,222,000	$ 75,222,000	$ 75,222,000	$ 75,222,000
	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------
Plan Benefits	$ -	$ 27,151,200	$ 27,151,200	$ 27,151,200	$ 27,151,200	$ 27,151,200	$ 27,151,200
Costs							
With Project Harbor Maintenance Costs	$ -	$ 21,006,100	$ 19,124,400	$ 17,946,300	$ 24,849,900	$ 17,120,700	$ 19,480,200
Without Project Habor maintenance Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------
Plan Costs	$ -	$ 21,006,100	$ 19,124,400	$ 17,946,300	$ 24,849,900	$ 17,120,700	$ 19,480,200
Plan Benefit Cost Ratios							
Plan Benefits	$ -	$ 27,151,200	$ 27,151,200	$ 27,151,200	$ 27,151,200	$ 27,151,200	$ 27,151,200
Plan Costs	$ -	$ 21,006,100	$ 19,124,400	$ 17,946,300	$ 24,849,900	$ 17,120,700	$ 19,480,200
Plan Benefit To Cost Ratio	0.00	1.29	1.42	1.51	1.09	1.59	1.39
Plan Net Benefits	$ -	$ 6,145,100	$ 8,026,800	$ 9,204,900	$ 2,301,300	$ 10,030,500	$ 7,671,000

Table 14 shows benefit to cost ratios ranging from 0.95 to 1.59. Plan 1, the No Action Plan, has no net benefits and no net costs. However, the No Action Plan does not provide any facilities to place sediments. This alterative does not meet the major goal of providing sediment storage facilities for a 20 year evaluation period. Plan 4 has the lowest average annual costs. Thus Plan 4 is the Base Plan. Plan 4 also has the highest net benefits. Thus Plan 4 is also the NED Plan.

VII. TENTATIVELY SELECTED PLAN

The main report compares the various plans taken to detailed evaluation, in order to identify a Tentatively Selected Plan. Plans 2-4a each have benefit to cost ratios greater than 1. Thus any of these plans could have been chosen as the Tentatively Selected Plan. Given such considerations as cubic capacity provided, impact on commercial navigation, costs, ability to phase construction, local sponsor preferences, and potential for future usage of the site by the local sponsor, Plan 4a- E 55th Street Locals Configuration, is the Tentatively Selected Plan.

VIII. COST SHARING OF TENTATIVLY SELECTED PLAN

A. Introduction

The Base Plan, which may or may not be the ultimate plan selected, defines the parameters to be used when determining cost-sharing for all other alternatives which may be developed during the study and which may be eventually put forward as the Tentatively Selected Plan. If the Tentatively Selected Plan has a higher cost than the Base Plan, all costs over the Base Plan costs are borne 100 percent by the non Federal Sponsor. All costs for the Tentatively Selected Plan, up to the costs of the Base Plan, are cost shared between the Federal and non-Federal sponsor.

The Base Plan is the Plan with the lowest average annual costs. Table 14 shows that Plan 4 is the Base Plan, with average annual costs of $17,120,700. The Tentatively Selected Plan is Plan 4a-E 55th St- Locals Configuration. This is not the Base Plan, and it is more expensive than the Base Plan. Thus all costs above the Base Plan costs are 100 percent the responsibility of the non-Federal sponsor. All remaining costs are cost shared.

B. Cost Sharing Guidelines

In general, the costs for implementing dredged material management plans for existing projects such as Cleveland Harbor are shared in accordance with navigation Operations and Maintenance (O&M) cost sharing provisions applicable to the authorized navigation project. Dredged material disposal facility costs, for new CDFs are cost-shared in accordance with Section 201 of the Water Resources Development Act of 1996 (P.L. 104-303) and United States Code (33 USC 2211). For commercial navigation projects where authorized depths range from greater than 20 feet to 45 feet, non-Federal sponsors are responsible for 25 percent of the initial cost of the facility and 100 percent of the cost of all lands, easements, rights-of-way, relocations, and disposal areas (LERRD). The non-Federal sponsor must also pay an additional 10 percent of the total project cost after construction over a maximum thirty year period. The non-Federal costs of LERRD (other than utility relocations) needed for the project is credited against this extra 10 percent non-Federal cost.

Portions of plans or entire plans that involve beneficial use of dredged material would be cost-shared on a 75 percent Federal and 25 percent non-Federal basis. Non-Federal sponsors are also responsible for the cost of LERRD for construction of the project which can be credited toward their 25 percent project share and 100 percent of the cost of operation and maintenance of the beneficial use plan. Implementation of Beneficial Use plans could be accomplished under Section 204 of the Water Resources Development Act of 1992, as amended.

In cases where a state agency imposes special requirements or alternatives for the disposal of dredged material, over and above that which is considered the Federal standard for that location, the additional costs associated with such requirements must be borne 100 percent by the non-Federal sponsor (33 CFR 337.2). The Federal Standard as defined in 33 CFR 335.7 is:

> *"Federal standard means the dredged material disposal alternative or alternatives identified by the Corps which represent the least costly alternatives consistent with sound engineering practices and meeting the environmental standards established by the 404(b)(1) evaluation process or ocean dumping criteria."*

In accordance with Section 217 of WRDA 96, the Corps may enter into agreements to provide additional capacity in a disposal facility for non-Federal dredged or excavated material such as material from berthing areas, non-Federal navigation channels and marinas. Non-Federal interests must agree to pay all the costs associated with the non-Federal capacity. In these cases, the disposal capacity in the disposal facility will be allocated between the capacity required for the maintenance (or improvement as applicable) of the Federal project and the capacity required for the non-Federal dredged material. Non-Federal interests will pay the non-Federal share of the costs of the capacity attributed to the Federal project(s) plus 100 percent of the cost allocated to the non-Federal dredged material capacity. A similar allocation will be made for the operation and maintenance costs of the disposal facility. The operation and maintenance costs attributable to the Federal project capacity will be shared in accordance with paragraph 7.a.(3) and the operation and maintenance costs associated with the non-Federal capacity will be 100 percent non-Federal. In general, the operation and maintenance of Federal and non-Federal disposal facilities will be accomplished by the Corps with annual payments by non-Federal interests for the non-Federal share of operation and maintenance costs. Payments and fees collected from non-Federal interests will be used for the operation and maintenance of the disposal facility in accordance with Section 217 of WRDA 96. Non-Federal operation and maintenance of Federal and non-Federal disposal facilities with annual payments of the Federal share will be considered on a case-by-case basis by HQUSACE. Non-Federal interests may recover the costs assigned to the additional capacity through fees assessed on third parties whose dredged material is deposited at the facility and who enter into agreements with the non-Federal interest for the use of the facility.

For the Cleveland Harbor DMMP, the Federal dredged material disposal requirement is 300,350 cy per year and the non-Federal dredged material disposal requirement is 37,870 cy per year. Therefore, approximately 88.80 percent of the per-cubic-yard total construction costs of a new CDF will be cost shared as described above, and the remaining 11.20 percent of the total per-cubic-yard total construction costs will be borne 100 percent by the non-Federal sponsor. Additionally, 100 percent of the operations and maintenance costs attributable to the 11.20 percent of the total CDF capacity will also be borne by the non-Federal sponsor.

C. Allocation of Tentatively Selected Plan Costs Based On Cost Sharing Guidelines

All costs associated with actually constructing the CDF proposed in the Base Plan ($260,097,900) and the Tentatively Selected Plan ($302,670,800) was identified. A total of nine general construction categories were identified:
1. General Construction of the CDF
2 Outfall relocations
3. Construction Related Reports/Coordination (USFWS and NEPA Coordination)
4. Real Estate
5. Develop & Execute PCA
6. Real Estate Acquisitions
7. Design Analysis,
8. Construction Management/Plans & Specs
9. Fish & Wildlife Mitigation.

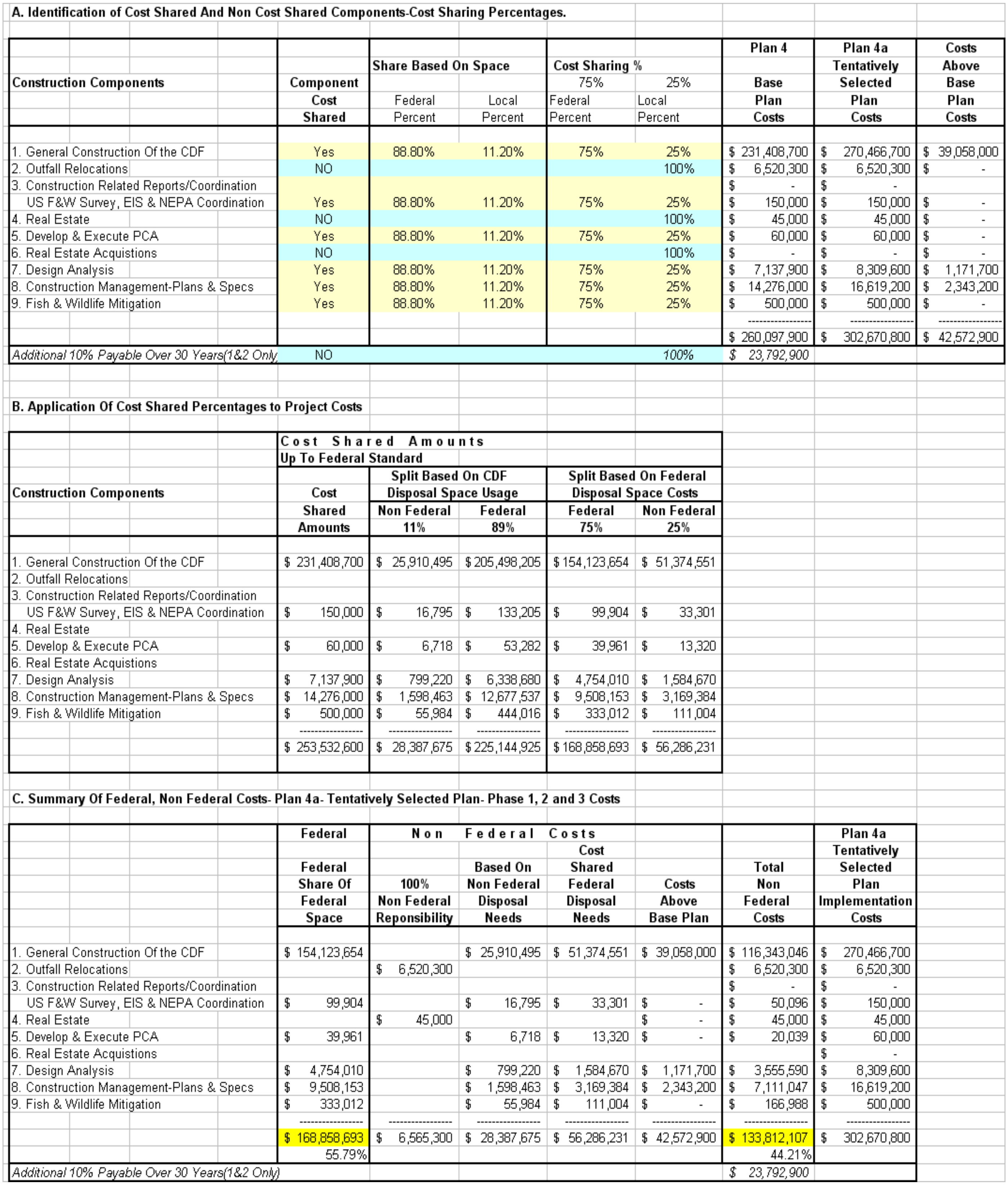
Each category was identified as to whether it was cost sharable or not. The applicable cost sharing percentages were also identified, based on space allocation for Federal and non-Federal sediment placement needs, and general cost sharing percentages. This procedure identified costs that could be cost shared up to the cost of the Federal Standard, and costs above the Federal Standard which are a 100 percent non federal responsibility. Table 15 Part A, summarizes this process.

Given that the amount of costs above the Base Plan costs are $42,572,900, these costs are a 100 percent non federal responsibility. Outfall relocations ($6,520,300) and real estate acquisitions ($45,000) are also a 100 percent non-Federal responsibility. This results in $253,532,600 that is applicable to various cost sharing percentages (See Table 15, Part B-Application of Cost Shared Percentages to Project Costs). First this amount is split into the cost of providing space for Federal and non federal use based on Federal (88.8 percent) and non-Federal (11.20 percent) sediment disposal needs over the CDFs 20 year life. Costs associated with providing CDF space for non federal sediments ($28, 387,675) is a 100 percent non-Federal cost. The remaining cost associated with providing CDF space for Federal sediments ($225,144,925) is cost shared 75 percent Federal, 25 percent non Federal. The federal cost share associated with providing space for federal sediments is $168,858,693. The non-Federal cost share associated with providing space for Federal sediments is $56,286,231.

Part C of Table 15 summarizes Federal and non-Federal costs associated with implementing the Tentatively Selected Plan. Federal costs are $168,858,693. Non Federal costs are $133,812,107. Non-federal costs have four components: 1.- costs defined as a 100 percent non federal responsibility-i.e. outfall relocations and LERRDs ($6,565,300), 2.- CDF Disposal Space used for non Federal Dredging needs ($28,387,675), 3.- cost share associated with providing CDF space for Federal disposal needs ($56,286,231), and 4.- all other costs above the Federal Standard ($42,572,900).

Total implementation costs for the Tentatively Selected plan is $302,670,800. The Federal share of these costs is approximately 55.8 percent ($168,858,700) and the non Federal share is approximately 44.2 percent ($133,812,100). In addition to these implementation costs, the non Federal sponsor is responsible for paying an additional 10 percent of the NED plans total project cost after construction over a maximum thirty year period (Plan 4). This additional 10 percent of total project cost comes to $23,792,900 ($231,408,700 + $6,520,300 = $237,929,000 x 10 percent = $23,792,900).

Table 15- Cost Sharing Allocation of Tentatively Selected Plan.



A. Identification of Cost Shared And Non Cost Shared Components-Cost Sharing Percentages.

Construction Components	Component Cost Shared	Share Based On Space Federal Percent	Local Percent	Cost Sharing % 75% Federal Percent	25% Local Percent	Plan 4 Base Plan Costs	Plan 4a Tentatively Selected Plan Costs	Costs Above Base Plan Costs
1. General Construction Of the CDF	Yes	88.80%	11.20%	75%	25%	$ 231,408,700	$ 270,466,700	$ 39,058,000
2. Outfall Relocations	NO				100%	$ 6,520,300	$ 6,520,300	$ -
3. Construction Related Reports/Coordination						$ -	$ -	
US F&W Survey, EIS & NEPA Coordination	Yes	88.80%	11.20%	75%	25%	$ 150,000	$ 150,000	$ -
4. Real Estate	NO				100%	$ 45,000	$ 45,000	$ -
5. Develop & Execute PCA	Yes	88.80%	11.20%	75%	25%	$ 60,000	$ 60,000	$ -
6. Real Estate Acquistions	NO				100%	$ -	$ -	$ -
7. Design Analysis	Yes	88.80%	11.20%	75%	25%	$ 7,137,900	$ 8,309,600	$ 1,171,700
8. Construction Management-Plans & Specs	Yes	88.80%	11.20%	75%	25%	$ 14,276,000	$ 16,619,200	$ 2,343,200
9. Fish & Wildlife Mitigation	Yes	88.80%	11.20%	75%	25%	$ 500,000	$ 500,000	$ -
						----------------	----------------	----------------
						$ 260,097,900	$ 302,670,800	$ 42,572,900
Additional 10% Payable Over 30 Years(1&2 Only	NO				*100%*	*$ 23,792,900*		

B. Application Of Cost Shared Percentages to Project Costs

Construction Components	Cost Shared Amounts Up To Federal Standard Cost Shared Amounts	Split Based On CDF Disposal Space Usage Non Federal 11%	Federal 89%	Split Based On Federal Disposal Space Costs Federal 75%	Non Federal 25%
1. General Construction Of the CDF	$ 231,408,700	$ 25,910,495	$ 205,498,205	$ 154,123,654	$ 51,374,551
2. Outfall Relocations					
3. Construction Related Reports/Coordination					
US F&W Survey, EIS & NEPA Coordination	$ 150,000	$ 16,795	$ 133,205	$ 99,904	$ 33,301
4. Real Estate					
5. Develop & Execute PCA	$ 60,000	$ 6,718	$ 53,282	$ 39,961	$ 13,320
6. Real Estate Acquistions					
7. Design Analysis	$ 7,137,900	$ 799,220	$ 6,338,680	$ 4,754,010	$ 1,584,670
8. Construction Management-Plans & Specs	$ 14,276,000	$ 1,598,463	$ 12,677,537	$ 9,508,153	$ 3,169,384
9. Fish & Wildlife Mitigation	$ 500,000	$ 55,984	$ 444,016	$ 333,012	$ 111,004
	----------------	----------------	----------------	----------------	----------------
	$ 253,532,600	$ 28,387,675	$ 225,144,925	$ 168,858,693	$ 56,286,231

C. Summary Of Federal, Non Federal Costs- Plan 4a- Tentatively Selected Plan- Phase 1, 2 and 3 Costs

	Federal Federal Share Of Federal Space	Non Federal Costs 100% Non Federal Reponsibility	Based On Non Federal Disposal Needs	Cost Shared Federal Disposal Needs	Costs Above Base Plan	Total Non Federal Costs	Plan 4a Tentatively Selected Plan Implementation Costs
1. General Construction Of the CDF	$ 154,123,654		$ 25,910,495	$ 51,374,551	$ 39,058,000	$ 116,343,046	$ 270,466,700
2. Outfall Relocations		$ 6,520,300				$ 6,520,300	$ 6,520,300
3. Construction Related Reports/Coordination						$ -	$ -
US F&W Survey, EIS & NEPA Coordination	$ 99,904		$ 16,795	$ 33,301	$ -	$ 50,096	$ 150,000
4. Real Estate		$ 45,000			$ -	$ 45,000	$ 45,000
5. Develop & Execute PCA	$ 39,961		$ 6,718	$ 13,320	$ -	$ 20,039	$ 60,000
6. Real Estate Acquistions							$ -
7. Design Analysis	$ 4,754,010		$ 799,220	$ 1,584,670	$ 1,171,700	$ 3,555,590	$ 8,309,600
8. Construction Management-Plans & Specs	$ 9,508,153		$ 1,598,463	$ 3,169,384	$ 2,343,200	$ 7,111,047	$ 16,619,200
9. Fish & Wildlife Mitigation	$ 333,012		$ 55,984	$ 111,004	$ -	$ 166,988	$ 500,000
	----------------	----------------	----------------	----------------	----------------	----------------	----------------
	$ 168,858,693	$ 6,565,300	$ 28,387,675	$ 56,286,231	$ 42,572,900	$ 133,812,107	$ 302,670,800
	55.79%					44.21%	
Additional 10% Payable Over 30 Years(1&2 Only)						*$ 23,792,900*	

APPENDIX G
Part III

CLEVELAND HARBOR DMMP
ECONOMIC EVALUATION
SENSITIVITY ANALYSIS

Cleveland Harbor DMMP
Economic Evaluation of Alternative Plans
Sensitivity Analysis

I. INTRODUCTION

The Planning Guidance Notebook (ER 1105-2-100, Appendix E, page 68, 22 April, 2000) says all Federally maintained projects must demonstrate that there is sufficient dredged material disposal capacity for a minimum of 20 years. The guidance (Appendix E, page 70) goes on to state that:

"Management Plans shall identify specific measures necessary to manage the volume of material likely to be dredged over a 20 year period, from both construction and maintenance dredging of Federal channel and harbor projects. Non-federal, permitted dredging within the related geographic area shall be considered in formulating Management Plans to the extent that disposal of material from these sources affects the size and capacity of disposal areas required for the Federal Project(s)."

Consequently Dredge Material Management Plans were developed for Cleveland Harbor that would accommodate all Federal and non federal dredging that would take place over the 20 year period 2009-2028. The plans developed were a combination of management of existing disposal sites to extend their useful life and the development of new disposal sites. The Plans included six years of CDF Dredge Material Management at CDFs that currently exist at Cleveland. The final array of DMMP Plans included new CDFs that would hold at least 20 years of dredging. Thus at the end of the 20 year evaluation period, the new CDFs still had 6 years of useful life remaining. Benefits and costs associated with these six years were not used in the economic evaluation.

However, the project evaluation period does not have to be limited to the next 20 years. The project evaluation period could be defined as continuing until the new CDFs design capacity was reached. This would allow all benefits and costs that accrue during the "Design Life" of the CDF to be accounted for. This Sensitivity Evaluation provides average annual benefits, average annual costs, benefit to cost ratios, and net benefits for all final plans (2, 2a, 3, 3a, 4 and 4a) based on a project evaluation period that continues for the "Design life" of the new CDFs.

For evaluation purposes it is assumed that all new CDFs can hold 20 years of dredging. This would place all new CDFs on the same basis with respect to usable life, when comparing benefits and costs associated with any one plan. Determination of the project evaluation period based on a 20 year new CDF "Useful Life" is provided in Table 1. Table 1 indicates the project evaluation period would be is 26 years long and run from 2009-2034. The actual components of this 26 year evaluation follow.

II. PROJECT BENEFITS

Benefits for this evaluation are the transportation cost increases avoided, by continuing to maintain the channels at Cleveland harbor. The difference in vessel transportation costs associated with maintaining current harbor depths (with Project Condition) and vessel transportation costs associated with discontinuing harbor dredging (without Project Condition), over a 26 year period, are the benefits associated with continuing to maintain the harbor.

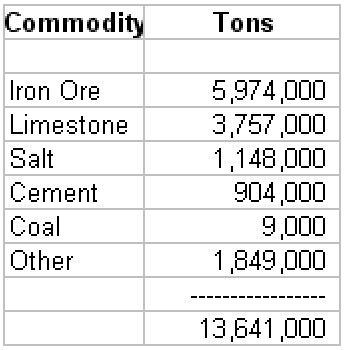
Table 1. Determination of Project Evaluation Period Based on NEW CDF Design Life

Project Year	Project Evaluation Period	Year CDF Comes On Line	20 Year Usable CDF Life
2009	1		
2010	2		
2011	3		
2012	4		
2013	5		
2014	6		
2015	7	CDF On Line	1
2016	8		2
2017	9		3
2018	10		4
2019	11		5
2020	12		6
2021	13		7
2022	14		8
2023	15		9
2024	16		10
2025	17		11
2026	18		12
2027	19		13
2028	20		14
2029	21		15
2030	22		16
2031	23		17
2032	24		18
2033	25		19
2034	26		20

A. Harbor Tonnages

Total tonnages handled at Cleveland Harbor in 2005 were 13,641,000. The main commodities handled were: iron ore (5,974,000) limestone (3,757,000), salt (1,148,000), cement (904,000) and coal (9,000). These commodities' accounted for 86 percent of the tonnage moving through the Harbor in 2005. These five commodities were used to develop net benefits associated with continued maintenance of the harbor. The vessels actually used to move these commodities were identified, as well as the origin/destination routes that these vessels used. The 2005 vessel movements are considered representative of vessel traffic patterns and tonnages that will take place at Cleveland Harbor over the 26 year evaluation period 2009-2034. A summary of 2005 tonnages, by commodity, is provided in Table 2.

Table 2. - Cleveland Harbor Tonnages- 2005



Commodity	Tons
Iron Ore	5,974,000
Limestone	3,757,000
Salt	1,148,000
Cement	904,000
Coal	9,000
Other	1,849,000

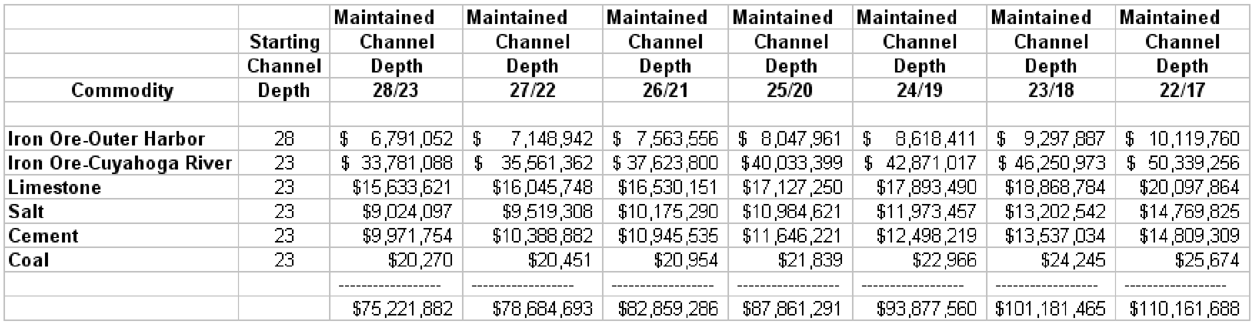
	13,641,000

B. With Project Condition Average Annual Vessel Transportation Costs

A computer model developed by Buffalo District calculated increases in vessel transportation costs for each vessel movement given reductions in channel depth. The analysis is done in one foot increments for a maximum decrease in channel depth of 6 feet. Thus the analysis evaluated vessel transportation costs associated with existing authorized maintained depths of 28/23 feet in the Outer Harbor and Cuyahoga/Old River, as well as channels with up to 6 feet less of water column in one foot increments.

Table 3 provides the annual transportation costs, for the five key commodities evaluated, for a range of maintained channel depths. The average annual transportation costs associated with continued maintenance of the harbors authorized 28/23 foot channels is equal to the annual transportation costs presented in the column labeled “Maintained Channel Depth 28/23”. These annual transportation costs come to $75,221,882. Thus With Project Condition average annual vessel transportation costs are $75,221,882.

Table 3. Cleveland Harbor- Vessel Transportation Costs, By Commodity, By Channel Depth



Commodity	Starting Channel Depth	Maintained Channel Depth 28/23	Maintained Channel Depth 27/22	Maintained Channel Depth 26/21	Maintained Channel Depth 25/20	Maintained Channel Depth 24/19	Maintained Channel Depth 23/18	Maintained Channel Depth 22/17
Iron Ore-Outer Harbor	28	$ 6,791,052	$ 7,148,942	$ 7,563,556	$ 8,047,961	$ 8,618,411	$ 9,297,887	$ 10,119,760
Iron Ore-Cuyahoga River	23	$ 33,781,088	$ 35,561,362	$ 37,623,800	$40,033,399	$ 42,871,017	$ 46,250,973	$ 50,339,256
Limestone	23	$15,633,621	$16,045,748	$16,530,151	$17,127,250	$17,893,490	$18,868,784	$20,097,864
Salt	23	$9,024,097	$9,519,308	$10,175,290	$10,984,621	$11,973,457	$13,202,542	$14,769,825
Cement	23	$9,971,754	$10,388,882	$10,945,535	$11,646,221	$12,498,219	$13,537,034	$14,809,309
Coal	23	$20,270	$20,451	$20,954	$21,839	$22,966	$24,245	$25,674
		------------------	------------------	------------------	------------------	------------------	------------------	------------------
		$75,221,882	$78,684,693	$82,859,286	$87,861,291	$93,877,560	$101,181,465	$110,161,688

C. Without Project Condition Average Annual Vessel Transportation Costs

If dredging at Cleveland Harbor was to cease, due to lack of a suitable dredged material management plan, the channels would gradually fill in, and additional transportation costs would be incurred as estimated in Table 3. Transportation costs associated with not maintaining the harbor is the transportation cost time stream that develops due to discontinued dredging, and the harbors annual shoaling rate. Shoaling rates at Cleveland harbor vary between the Outer Harbor (.2 of a foot per year) and the Cuyahoga/Old River (1-3 feet per year).

The evaluation looked at two different shoaling rates on the River: one foot per year and 2 feet per year. Channels were allowed to shoal up 6 feet and then remain at that depth for the remainder of the 26 year evaluation period. The River channels equilibrium channel depth was assumed to be 17 feet. Transportation cost time streams were developed for a 26 year evaluation period based on these shoaling rates and the annual transportation costs by maintained channel depth provided in Table 3. Table 4 provides a summary of these transportation cost time streams, under the two shoaling rate scenarios.

These time streams were converted to average annual values using a 26 year project life and a 4.625 percent annual interest rate. Actual calculation of Without Project Condition vessel transportation costs for the five key commodities are provided in Table 5. Iron ore vessel transportation costs were broken out into Outer harbor and Cuyahoga River based on tonnages that passed through these two areas. Iron ore tonnages destined for the Cuyahoga River represent about 83 percent of all iron ore tonnages handled at the Harbor. Thus 83 percent of total iron ore transportation costs were associated with the Cuyahoga River. This allowed different shoaling rates (outer Harbor-.2 foot per year versus Cuyahoga river at 1 to 2 feet per year) to be applied to the iron ore transportation cost time streams.

Average annual WOP condition vessel transportation costs are summarized in Table 6 by commodity. The total average annual vessel transportation costs associated with not maintaining the harbor over a 26 year evaluation period range from $101,146,700 to $103,292,900.

D. Average Annual Harbor Transportation Benefits

Average annual harbor transportation cost savings associated with continuing to maintain harbor channel depths is the difference in average annual transportation costs between the WOP condition and providing currently maintained depths of 28 feet ($75,221,882). Average annual harbor transportation cost savings associated with maintaining a 28/23 foot channel depth are between $24,924,700 and $28,070,900 (See Table 7).

III. DEVELOPMENT OF PLAN AVERAGE ANNUAL COSTS

All of the expenditures by plan that would take over the 26 year project evaluation period were identified and placed into a time stream. These major expenditures included dredging costs, implementing the FMP, new disposal site implementation costs (real estate, land costs, CDF engineering and design, plans and specs, construction costs, etc) and fish habitat development. Other project construction/report related costs were identified (USFWS and NEPA report costs).

Table 4. Cleveland Harbor WOP Condition Transportation Cost Time Streams

Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=1 Foot/Year

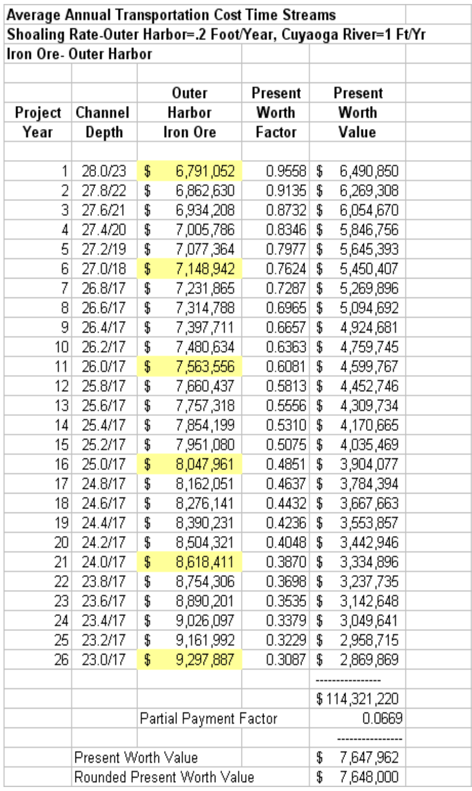
Project Year	Channel Depth	Outer Harbor Iron Ore	Cuyahoga River Iron Ore	Cuyahoga River Limestone	Old River Salt	Cuyahoga River Cement	Cuyahoga River Coal
1	28.0/23	$ 6,791,052	$ 33,781,088	$15,633,621	$ 9,024,097	$ 9,971,754	$ 20,270
2	27.8/22	$ 6,862,630	$ 35,561,362	$16,045,748	$ 9,519,308	$ 10,388,882	$ 20,451
3	27.6/21	$ 6,934,208	$ 37,623,800	$16,530,151	$ 10,175,290	$ 10,945,535	$ 20,954
4	27.4/20	$ 7,005,786	$ 40,033,399	$17,127,250	$ 10,984,621	$ 11,646,221	$ 21,839
5	27.2/19	$ 7,077,364	$ 42,871,017	$17,893,490	$ 11,973,457	$ 12,498,219	$ 22,966
6	27.0/18	$ 7,148,942	$ 46,250,973	$18,868,784	$ 13,202,542	$ 13,537,034	$ 24,245
7	26.8/17	$ 7,231,865	$ 50,339,256	$20,097,864	$ 14,769,825	$ 14,809,309	$ 25,674
8	26.6/17	$ 7,314,788	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
9	26.4/17	$ 7,397,711	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
10	26.2/17	$ 7,480,634	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
11	26.0/17	$ 7,563,556	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
12	25.8/17	$ 7,660,437	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
13	25.6/17	$ 7,757,318	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
14	25.4/17	$ 7,854,199	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
15	25.2/17	$ 7,951,080	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
16	25.0/17	$ 8,047,961	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
17	24.8/17	$ 8,162,051	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
18	24.6/17	$ 8,276,141	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
19	24.4/17	$ 8,390,231	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
20	24.2/17	$ 8,504,321	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
21	24.0/17	$ 8,618,411	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
22	23.8/17	$ 8,754,306	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
23	23.6/17	$ 8,890,201	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
24	23.4/17	$ 9,026,097	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
25	23.2/17	$ 9,161,992	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
26	23.0/17	$ 9,297,887	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674

Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=2 Feet/Year

Project Year	Channel Depth	Outer Harbor Iron Ore	Cuyahoga River Iron Ore	Cuyahoga River Limestone	Old River Salt	Cuyahoga River Cement	Cuyahoga River Coal
1	28.0/23	$ 6,791,052	$ 33,781,088	$15,633,621	$ 9,024,097	$ 9,971,754	$ 20,270
2	27.8/21	$ 6,862,630	$ 37,623,800	$16,530,151	$ 10,175,290	$ 10,945,535	$ 20,954
3	27.6/19	$ 6,934,208	$ 42,871,017	$17,893,490	$ 11,973,457	$ 12,498,219	$ 22,966
4	27.4/17	$ 7,005,786	$ 50,339,256	$20,097,864	$ 14,769,825	$ 14,809,309	$ 25,674
5	27.2/17	$ 7,077,364	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
6	27.0/17	$ 7,148,942	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
7	26.8/17	$ 7,231,865	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
8	26.6/17	$ 7,314,788	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
9	26.4/17	$ 7,397,711	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
10	26.2/17	$ 7,480,634	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
11	26.0/17	$ 7,563,556	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
12	25.8/17	$ 7,660,437	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
13	25.6/17	$ 7,757,318	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
14	25.4/17	$ 7,854,199	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
15	25.2/17	$ 7,951,080	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
16	25.0/17	$ 8,047,961	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
17	24.8/17	$ 8,162,051	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
18	24.6/17	$ 8,276,141	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
19	24.4/17	$ 8,390,231	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
20	24.2/17	$ 8,504,321	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
21	24.0/17	$ 8,618,411	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
22	23.8/17	$ 8,754,306	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
23	23.6/17	$ 8,890,201	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
24	23.4/17	$ 9,026,097	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
25	23.2/17	$ 9,161,992	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674
26	23.0/17	$ 9,297,887	$ 50,339,256	$20,097,864	$14,769,825	$14,809,309	$25,674

Table 5- Computation Of WOP Condition Average Annual Vessel Transportation Costs

A. WOP Condition- Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyahoga/Old River=1 Foot/Year

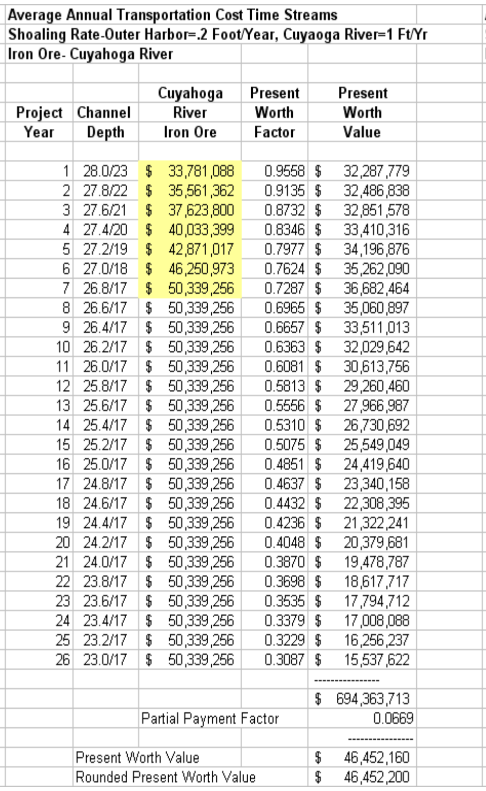


Average Annual Transportation Cost Time Streams
Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=1 Ft/Yr
Iron Ore- Outer Harbor

Project Year	Channel Depth	Outer Harbor Iron Ore	Present Worth Factor	Present Worth Value
1	28.0/23	$ 6,791,052	0.9558	$ 6,490,850
2	27.8/22	$ 6,862,630	0.9135	$ 6,269,308
3	27.6/21	$ 6,934,208	0.8732	$ 6,054,670
4	27.4/20	$ 7,005,786	0.8346	$ 5,846,756
5	27.2/19	$ 7,077,364	0.7977	$ 5,645,393
6	27.0/18	$ 7,148,942	0.7624	$ 5,450,407
7	26.8/17	$ 7,231,865	0.7287	$ 5,269,896
8	26.6/17	$ 7,314,788	0.6965	$ 5,094,692
9	26.4/17	$ 7,397,711	0.6657	$ 4,924,681
10	26.2/17	$ 7,480,634	0.6363	$ 4,759,745
11	26.0/17	$ 7,563,556	0.6081	$ 4,599,767
12	25.8/17	$ 7,660,437	0.5813	$ 4,452,746
13	25.6/17	$ 7,757,318	0.5556	$ 4,309,734
14	25.4/17	$ 7,854,199	0.5310	$ 4,170,665
15	25.2/17	$ 7,951,080	0.5075	$ 4,035,469
16	25.0/17	$ 8,047,961	0.4851	$ 3,904,077
17	24.8/17	$ 8,162,051	0.4637	$ 3,784,394
18	24.6/17	$ 8,276,141	0.4432	$ 3,667,663
19	24.4/17	$ 8,390,231	0.4236	$ 3,553,857
20	24.2/17	$ 8,504,321	0.4048	$ 3,442,946
21	24.0/17	$ 8,618,411	0.3870	$ 3,334,896
22	23.8/17	$ 8,754,306	0.3698	$ 3,237,735
23	23.6/17	$ 8,890,201	0.3535	$ 3,142,648
24	23.4/17	$ 9,026,097	0.3379	$ 3,049,641
25	23.2/17	$ 9,161,992	0.3229	$ 2,958,715
26	23.0/17	$ 9,297,887	0.3087	$ 2,869,869

				$ 114,321,220
		Partial Payment Factor		0.0669

	Present Worth Value			$ 7,647,962
	Rounded Present Worth Value			$ 7,648,000

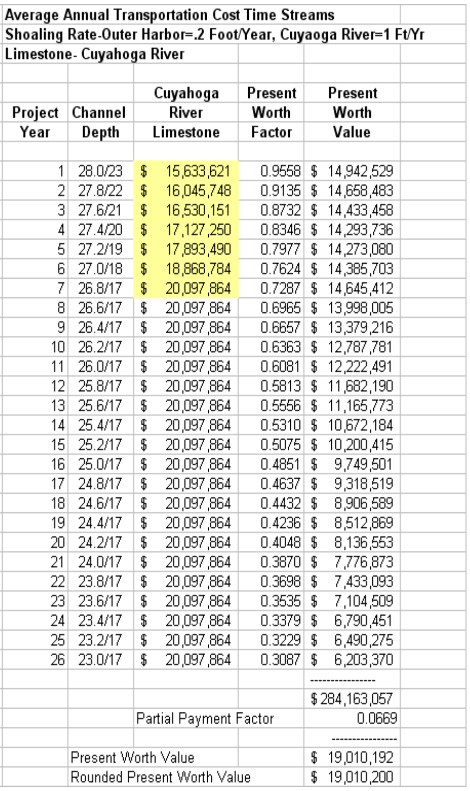


Average Annual Transportation Cost Time Streams
Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=1 Ft/Yr
Iron Ore- Cuyahoga River

Project Year	Channel Depth	Cuyahoga River Iron Ore	Present Worth Factor	Present Worth Value
1	28.0/23	$ 33,781,088	0.9558	$ 32,287,779
2	27.8/22	$ 35,561,362	0.9135	$ 32,486,838
3	27.6/21	$ 37,623,800	0.8732	$ 32,851,578
4	27.4/20	$ 40,033,399	0.8346	$ 33,410,316
5	27.2/19	$ 42,871,017	0.7977	$ 34,196,876
6	27.0/18	$ 46,250,973	0.7624	$ 35,262,090
7	26.8/17	$ 50,339,256	0.7287	$ 36,682,464
8	26.6/17	$ 50,339,256	0.6965	$ 35,060,897
9	26.4/17	$ 50,339,256	0.6657	$ 33,511,013
10	26.2/17	$ 50,339,256	0.6363	$ 32,029,642
11	26.0/17	$ 50,339,256	0.6081	$ 30,613,756
12	25.8/17	$ 50,339,256	0.5813	$ 29,260,460
13	25.6/17	$ 50,339,256	0.5556	$ 27,966,987
14	25.4/17	$ 50,339,256	0.5310	$ 26,730,692
15	25.2/17	$ 50,339,256	0.5075	$ 25,549,049
16	25.0/17	$ 50,339,256	0.4851	$ 24,419,640
17	24.8/17	$ 50,339,256	0.4637	$ 23,340,158
18	24.6/17	$ 50,339,256	0.4432	$ 22,308,395
19	24.4/17	$ 50,339,256	0.4236	$ 21,322,241
20	24.2/17	$ 50,339,256	0.4048	$ 20,379,681
21	24.0/17	$ 50,339,256	0.3870	$ 19,478,787
22	23.8/17	$ 50,339,256	0.3698	$ 18,617,717
23	23.6/17	$ 50,339,256	0.3535	$ 17,794,712
24	23.4/17	$ 50,339,256	0.3379	$ 17,008,088
25	23.2/17	$ 50,339,256	0.3229	$ 16,256,237
26	23.0/17	$ 50,339,256	0.3087	$ 15,537,622

				$ 694,363,713
		Partial Payment Factor		0.0669

	Present Worth Value			$ 46,452,160
	Rounded Present Worth Value			$ 46,452,200

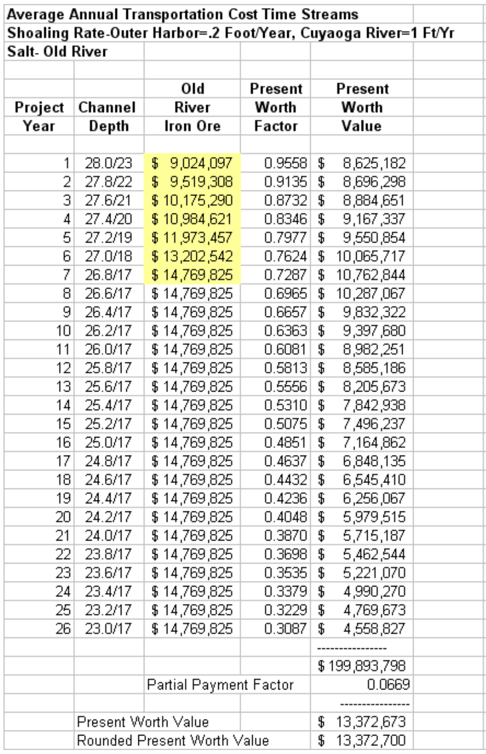


Average Annual Transportation Cost Time Streams
Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=1 Ft/Yr
Limestone- Cuyahoga River

Project Year	Channel Depth	Cuyahoga River Limestone	Present Worth Factor	Present Worth Value
1	28.0/23	$ 15,633,621	0.9558	$ 14,942,529
2	27.8/22	$ 16,045,748	0.9135	$ 14,658,483
3	27.6/21	$ 16,530,151	0.8732	$ 14,433,458
4	27.4/20	$ 17,127,250	0.8346	$ 14,293,736
5	27.2/19	$ 17,893,490	0.7977	$ 14,273,080
6	27.0/18	$ 18,868,784	0.7624	$ 14,385,703
7	26.8/17	$ 20,097,864	0.7287	$ 14,645,412
8	26.6/17	$ 20,097,864	0.6965	$ 13,998,005
9	26.4/17	$ 20,097,864	0.6657	$ 13,379,216
10	26.2/17	$ 20,097,864	0.6363	$ 12,787,781
11	26.0/17	$ 20,097,864	0.6081	$ 12,222,491
12	25.8/17	$ 20,097,864	0.5813	$ 11,682,190
13	25.6/17	$ 20,097,864	0.5556	$ 11,165,773
14	25.4/17	$ 20,097,864	0.5310	$ 10,672,184
15	25.2/17	$ 20,097,864	0.5075	$ 10,200,415
16	25.0/17	$ 20,097,864	0.4851	$ 9,749,501
17	24.8/17	$ 20,097,864	0.4637	$ 9,318,519
18	24.6/17	$ 20,097,864	0.4432	$ 8,906,589
19	24.4/17	$ 20,097,864	0.4236	$ 8,512,869
20	24.2/17	$ 20,097,864	0.4048	$ 8,136,553
21	24.0/17	$ 20,097,864	0.3870	$ 7,776,873
22	23.8/17	$ 20,097,864	0.3698	$ 7,433,093
23	23.6/17	$ 20,097,864	0.3535	$ 7,104,509
24	23.4/17	$ 20,097,864	0.3379	$ 6,790,451
25	23.2/17	$ 20,097,864	0.3229	$ 6,490,275
26	23.0/17	$ 20,097,864	0.3087	$ 6,203,370

				$ 284,163,057
		Partial Payment Factor		0.0669

	Present Worth Value			$ 19,010,192
	Rounded Present Worth Value			$ 19,010,200

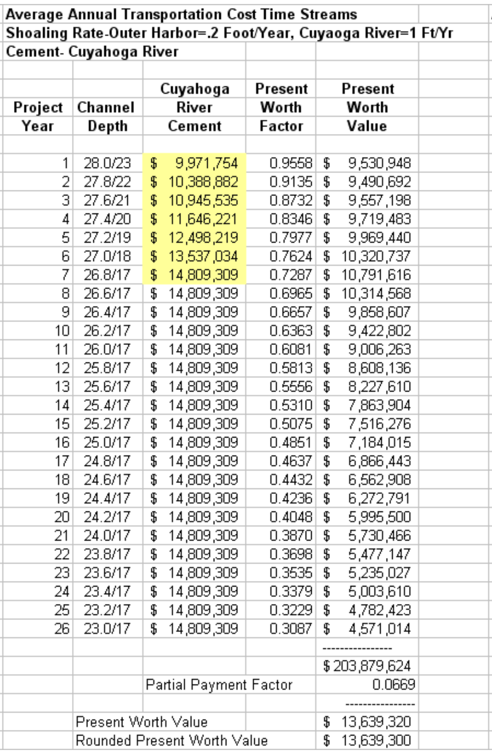


Average Annual Transportation Cost Time Streams
Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=1 Ft/Yr
Salt- Old River

Project Year	Channel Depth	Old River Iron Ore	Present Worth Factor	Present Worth Value
1	28.0/23	$ 9,024,097	0.9558	$ 8,625,182
2	27.8/22	$ 9,519,308	0.9135	$ 8,696,298
3	27.6/21	$ 10,175,290	0.8732	$ 8,884,651
4	27.4/20	$ 10,984,621	0.8346	$ 9,167,337
5	27.2/19	$ 11,973,457	0.7977	$ 9,550,854
6	27.0/18	$ 13,202,542	0.7624	$ 10,065,717
7	26.8/17	$ 14,769,825	0.7287	$ 10,762,844
8	26.6/17	$ 14,769,825	0.6965	$ 10,287,067
9	26.4/17	$ 14,769,825	0.6657	$ 9,832,322
10	26.2/17	$ 14,769,825	0.6363	$ 9,397,680
11	26.0/17	$ 14,769,825	0.6081	$ 8,982,251
12	25.8/17	$ 14,769,825	0.5813	$ 8,585,186
13	25.6/17	$ 14,769,825	0.5556	$ 8,205,673
14	25.4/17	$ 14,769,825	0.5310	$ 7,842,938
15	25.2/17	$ 14,769,825	0.5075	$ 7,496,237
16	25.0/17	$ 14,769,825	0.4851	$ 7,164,862
17	24.8/17	$ 14,769,825	0.4637	$ 6,848,135
18	24.6/17	$ 14,769,825	0.4432	$ 6,545,410
19	24.4/17	$ 14,769,825	0.4236	$ 6,256,067
20	24.2/17	$ 14,769,825	0.4048	$ 5,979,515
21	24.0/17	$ 14,769,825	0.3870	$ 5,715,187
22	23.8/17	$ 14,769,825	0.3698	$ 5,462,544
23	23.6/17	$ 14,769,825	0.3535	$ 5,221,070
24	23.4/17	$ 14,769,825	0.3379	$ 4,990,270
25	23.2/17	$ 14,769,825	0.3229	$ 4,769,673
26	23.0/17	$ 14,769,825	0.3087	$ 4,558,827

				$ 199,893,798
		Partial Payment Factor		0.0669

	Present Worth Value			$ 13,372,673
	Rounded Present Worth Value			$ 13,372,700

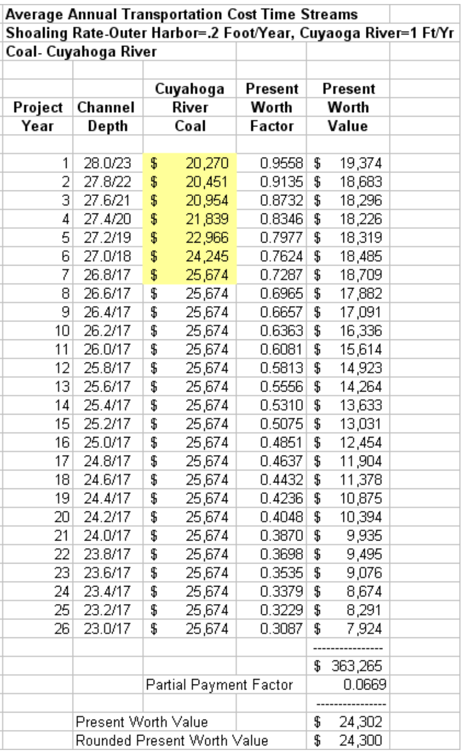


Average Annual Transportation Cost Time Streams
Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=1 Ft/Yr
Cement- Cuyahoga River

Project Year	Channel Depth	Cuyahoga River Cement	Present Worth Factor	Present Worth Value
1	28.0/23	$ 9,971,754	0.9558	$ 9,530,948
2	27.8/22	$ 10,388,882	0.9135	$ 9,490,692
3	27.6/21	$ 10,945,535	0.8732	$ 9,557,198
4	27.4/20	$ 11,646,221	0.8346	$ 9,719,483
5	27.2/19	$ 12,498,219	0.7977	$ 9,969,440
6	27.0/18	$ 13,537,034	0.7624	$ 10,320,737
7	26.8/17	$ 14,809,309	0.7287	$ 10,791,616
8	26.6/17	$ 14,809,309	0.6965	$ 10,314,568
9	26.4/17	$ 14,809,309	0.6657	$ 9,858,607
10	26.2/17	$ 14,809,309	0.6363	$ 9,422,802
11	26.0/17	$ 14,809,309	0.6081	$ 9,006,263
12	25.8/17	$ 14,809,309	0.5813	$ 8,608,136
13	25.6/17	$ 14,809,309	0.5556	$ 8,227,610
14	25.4/17	$ 14,809,309	0.5310	$ 7,863,904
15	25.2/17	$ 14,809,309	0.5075	$ 7,516,276
16	25.0/17	$ 14,809,309	0.4851	$ 7,184,015
17	24.8/17	$ 14,809,309	0.4637	$ 6,866,443
18	24.6/17	$ 14,809,309	0.4432	$ 6,562,908
19	24.4/17	$ 14,809,309	0.4236	$ 6,272,791
20	24.2/17	$ 14,809,309	0.4048	$ 5,995,500
21	24.0/17	$ 14,809,309	0.3870	$ 5,730,466
22	23.8/17	$ 14,809,309	0.3698	$ 5,477,147
23	23.6/17	$ 14,809,309	0.3535	$ 5,235,027
24	23.4/17	$ 14,809,309	0.3379	$ 5,003,610
25	23.2/17	$ 14,809,309	0.3229	$ 4,782,423
26	23.0/17	$ 14,809,309	0.3087	$ 4,571,014

				$ 203,879,624
		Partial Payment Factor		0.0669

	Present Worth Value			$ 13,639,320
	Rounded Present Worth Value			$ 13,639,300



Average Annual Transportation Cost Time Streams
Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=1 Ft/Yr
Coal- Cuyahoga River

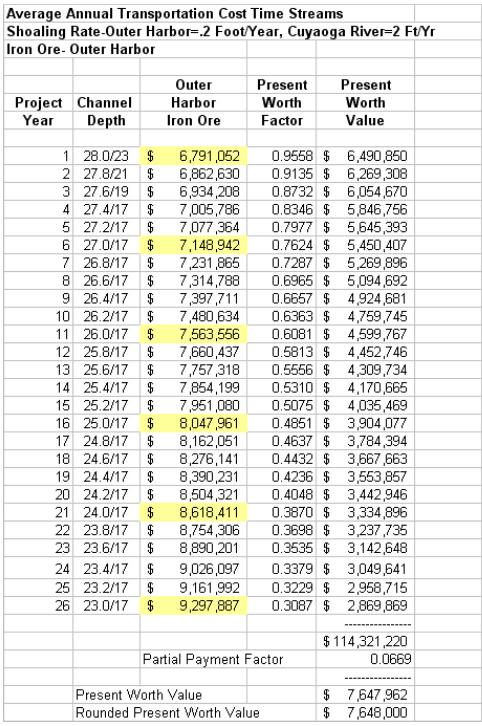
Project Year	Channel Depth	Cuyahoga River Coal	Present Worth Factor	Present Worth Value
1	28.0/23	$ 20,270	0.9558	$ 19,374
2	27.8/22	$ 20,451	0.9135	$ 18,683
3	27.6/21	$ 20,954	0.8732	$ 18,296
4	27.4/20	$ 21,839	0.8346	$ 18,226
5	27.2/19	$ 22,966	0.7977	$ 18,319
6	27.0/18	$ 24,245	0.7624	$ 18,485
7	26.8/17	$ 25,674	0.7287	$ 18,709
8	26.6/17	$ 25,674	0.6965	$ 17,882
9	26.4/17	$ 25,674	0.6657	$ 17,091
10	26.2/17	$ 25,674	0.6363	$ 16,336
11	26.0/17	$ 25,674	0.6081	$ 15,614
12	25.8/17	$ 25,674	0.5813	$ 14,923
13	25.6/17	$ 25,674	0.5556	$ 14,264
14	25.4/17	$ 25,674	0.5310	$ 13,633
15	25.2/17	$ 25,674	0.5075	$ 13,031
16	25.0/17	$ 25,674	0.4851	$ 12,454
17	24.8/17	$ 25,674	0.4637	$ 11,904
18	24.6/17	$ 25,674	0.4432	$ 11,378
19	24.4/17	$ 25,674	0.4236	$ 10,875
20	24.2/17	$ 25,674	0.4048	$ 10,394
21	24.0/17	$ 25,674	0.3870	$ 9,935
22	23.8/17	$ 25,674	0.3698	$ 9,495
23	23.6/17	$ 25,674	0.3535	$ 9,076
24	23.4/17	$ 25,674	0.3379	$ 8,674
25	23.2/17	$ 25,674	0.3229	$ 8,291
26	23.0/17	$ 25,674	0.3087	$ 7,924

				$ 363,265
		Partial Payment Factor		0.0669

	Present Worth Value			$ 24,302
	Rounded Present Worth Value			$ 24,300

Table 5- Computation Of WOP Condition Average Annual Vessel Transportation Costs

B. WOP Condition- Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyahoga/Old River=2 Feet/Year

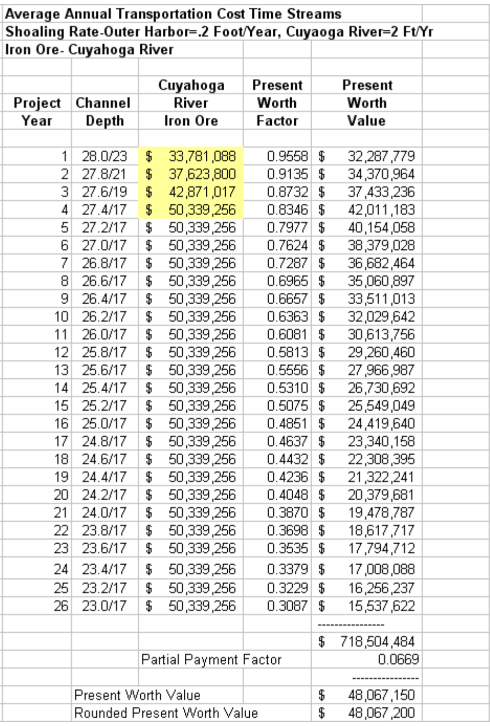


Average Annual Transportation Cost Time Streams
Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=2 Ft/Yr
Iron Ore- Outer Harbor

Project Year	Channel Depth	Outer Harbor Iron Ore	Present Worth Factor	Present Worth Value
1	28.0/23	$ 6,791,052	0.9558	$ 6,490,850
2	27.8/21	$ 6,862,630	0.9135	$ 6,269,308
3	27.6/19	$ 6,934,208	0.8732	$ 6,054,670
4	27.4/17	$ 7,005,786	0.8346	$ 5,846,756
5	27.2/17	$ 7,077,364	0.7977	$ 5,645,393
6	27.0/17	$ 7,148,942	0.7624	$ 5,450,407
7	26.8/17	$ 7,231,865	0.7287	$ 5,269,896
8	26.6/17	$ 7,314,788	0.6965	$ 5,094,692
9	26.4/17	$ 7,397,711	0.6657	$ 4,924,681
10	26.2/17	$ 7,480,634	0.6363	$ 4,759,745
11	26.0/17	$ 7,563,556	0.6081	$ 4,599,767
12	25.8/17	$ 7,660,437	0.5813	$ 4,452,746
13	25.6/17	$ 7,757,318	0.5556	$ 4,309,734
14	25.4/17	$ 7,854,199	0.5310	$ 4,170,665
15	25.2/17	$ 7,951,080	0.5075	$ 4,035,469
16	25.0/17	$ 8,047,961	0.4851	$ 3,904,077
17	24.8/17	$ 8,162,051	0.4637	$ 3,784,394
18	24.6/17	$ 8,276,141	0.4432	$ 3,667,663
19	24.4/17	$ 8,390,231	0.4236	$ 3,553,857
20	24.2/17	$ 8,504,321	0.4048	$ 3,442,946
21	24.0/17	$ 8,618,411	0.3870	$ 3,334,896
22	23.8/17	$ 8,754,306	0.3698	$ 3,237,735
23	23.6/17	$ 8,890,201	0.3535	$ 3,142,648
24	23.4/17	$ 9,026,097	0.3379	$ 3,049,641
25	23.2/17	$ 9,161,992	0.3229	$ 2,958,715
26	23.0/17	$ 9,297,887	0.3087	$ 2,869,869

				$ 114,321,220
		Partial Payment Factor		0.0669

	Present Worth Value			$ 7,647,962
	Rounded Present Worth Value			$ 7,648,000

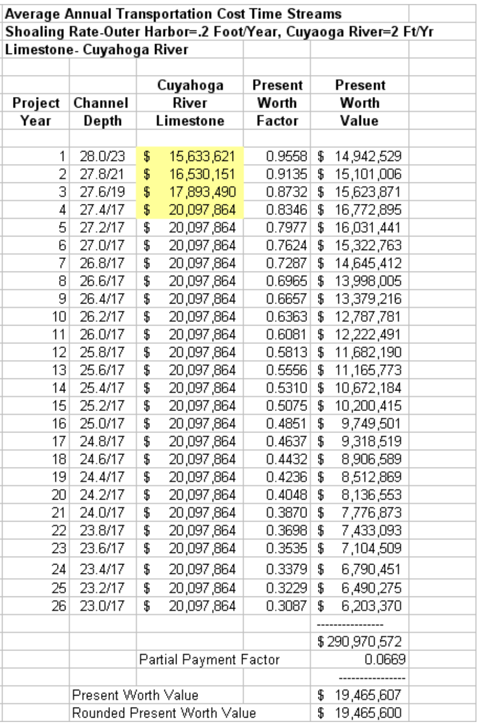


Average Annual Transportation Cost Time Streams
Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=2 Ft/Yr
Iron Ore- Cuyahoga River

Project Year	Channel Depth	Cuyahoga River Iron Ore	Present Worth Factor	Present Worth Value
1	28.0/23	$ 33,781,088	0.9558	$ 32,287,779
2	27.8/21	$ 37,623,800	0.9135	$ 34,370,964
3	27.6/19	$ 42,871,017	0.8732	$ 37,433,236
4	27.4/17	$ 50,339,256	0.8346	$ 42,011,183
5	27.2/17	$ 50,339,256	0.7977	$ 40,154,058
6	27.0/17	$ 50,339,256	0.7624	$ 38,379,028
7	26.8/17	$ 50,339,256	0.7287	$ 36,682,464
8	26.6/17	$ 50,339,256	0.6965	$ 35,060,897
9	26.4/17	$ 50,339,256	0.6657	$ 33,511,013
10	26.2/17	$ 50,339,256	0.6363	$ 32,029,642
11	26.0/17	$ 50,339,256	0.6081	$ 30,613,756
12	25.8/17	$ 50,339,256	0.5813	$ 29,260,460
13	25.6/17	$ 50,339,256	0.5556	$ 27,966,987
14	25.4/17	$ 50,339,256	0.5310	$ 26,730,692
15	25.2/17	$ 50,339,256	0.5075	$ 25,549,049
16	25.0/17	$ 50,339,256	0.4851	$ 24,419,640
17	24.8/17	$ 50,339,256	0.4637	$ 23,340,158
18	24.6/17	$ 50,339,256	0.4432	$ 22,308,395
19	24.4/17	$ 50,339,256	0.4236	$ 21,322,241
20	24.2/17	$ 50,339,256	0.4048	$ 20,379,681
21	24.0/17	$ 50,339,256	0.3870	$ 19,478,787
22	23.8/17	$ 50,339,256	0.3698	$ 18,617,717
23	23.6/17	$ 50,339,256	0.3535	$ 17,794,712
24	23.4/17	$ 50,339,256	0.3379	$ 17,008,088
25	23.2/17	$ 50,339,256	0.3229	$ 16,256,237
26	23.0/17	$ 50,339,256	0.3087	$ 15,537,622

				$ 718,504,484
		Partial Payment Factor		0.0669

	Present Worth Value			$ 48,067,150
	Rounded Present Worth Value			$ 48,067,200

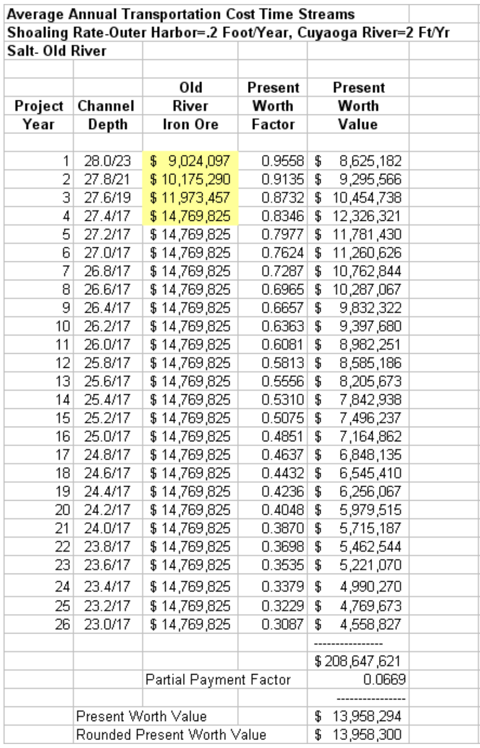


Average Annual Transportation Cost Time Streams
Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=2 Ft/Yr
Limestone- Cuyahoga River

Project Year	Channel Depth	Cuyahoga River Limestone	Present Worth Factor	Present Worth Value
1	28.0/23	$ 15,633,621	0.9558	$ 14,942,529
2	27.8/21	$ 16,530,151	0.9135	$ 15,101,006
3	27.6/19	$ 17,893,490	0.8732	$ 15,623,871
4	27.4/17	$ 20,097,864	0.8346	$ 16,772,895
5	27.2/17	$ 20,097,864	0.7977	$ 16,031,441
6	27.0/17	$ 20,097,864	0.7624	$ 15,322,763
7	26.8/17	$ 20,097,864	0.7287	$ 14,645,412
8	26.6/17	$ 20,097,864	0.6965	$ 13,998,005
9	26.4/17	$ 20,097,864	0.6657	$ 13,379,216
10	26.2/17	$ 20,097,864	0.6363	$ 12,787,781
11	26.0/17	$ 20,097,864	0.6081	$ 12,222,491
12	25.8/17	$ 20,097,864	0.5813	$ 11,682,190
13	25.6/17	$ 20,097,864	0.5556	$ 11,165,773
14	25.4/17	$ 20,097,864	0.5310	$ 10,672,184
15	25.2/17	$ 20,097,864	0.5075	$ 10,200,415
16	25.0/17	$ 20,097,864	0.4851	$ 9,749,501
17	24.8/17	$ 20,097,864	0.4637	$ 9,318,519
18	24.6/17	$ 20,097,864	0.4432	$ 8,906,589
19	24.4/17	$ 20,097,864	0.4236	$ 8,512,869
20	24.2/17	$ 20,097,864	0.4048	$ 8,136,553
21	24.0/17	$ 20,097,864	0.3870	$ 7,776,873
22	23.8/17	$ 20,097,864	0.3698	$ 7,433,093
23	23.6/17	$ 20,097,864	0.3535	$ 7,104,509
24	23.4/17	$ 20,097,864	0.3379	$ 6,790,451
25	23.2/17	$ 20,097,864	0.3229	$ 6,490,275
26	23.0/17	$ 20,097,864	0.3087	$ 6,203,370

				$ 290,970,572
		Partial Payment Factor		0.0669

	Present Worth Value			$ 19,465,607
	Rounded Present Worth Value			$ 19,465,600

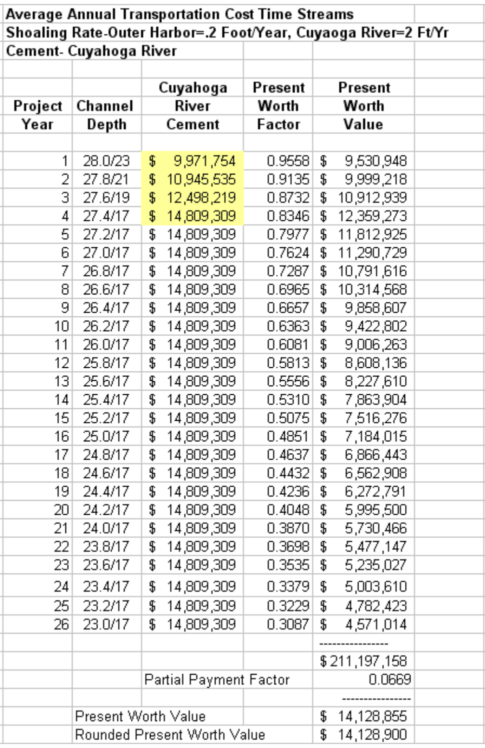


Average Annual Transportation Cost Time Streams
Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=2 Ft/Yr
Salt- Old River

Project Year	Channel Depth	Old River Iron Ore	Present Worth Factor	Present Worth Value
1	28.0/23	$ 9,024,097	0.9558	$ 8,625,182
2	27.8/21	$ 10,175,290	0.9135	$ 9,295,566
3	27.6/19	$ 11,973,457	0.8732	$ 10,454,738
4	27.4/17	$ 14,769,825	0.8346	$ 12,326,321
5	27.2/17	$ 14,769,825	0.7977	$ 11,781,430
6	27.0/17	$ 14,769,825	0.7624	$ 11,260,626
7	26.8/17	$ 14,769,825	0.7287	$ 10,762,844
8	26.6/17	$ 14,769,825	0.6965	$ 10,287,067
9	26.4/17	$ 14,769,825	0.6657	$ 9,832,322
10	26.2/17	$ 14,769,825	0.6363	$ 9,397,680
11	26.0/17	$ 14,769,825	0.6081	$ 8,982,251
12	25.8/17	$ 14,769,825	0.5813	$ 8,585,186
13	25.6/17	$ 14,769,825	0.5556	$ 8,205,673
14	25.4/17	$ 14,769,825	0.5310	$ 7,842,938
15	25.2/17	$ 14,769,825	0.5075	$ 7,496,237
16	25.0/17	$ 14,769,825	0.4851	$ 7,164,862
17	24.8/17	$ 14,769,825	0.4637	$ 6,848,135
18	24.6/17	$ 14,769,825	0.4432	$ 6,545,410
19	24.4/17	$ 14,769,825	0.4236	$ 6,256,067
20	24.2/17	$ 14,769,825	0.4048	$ 5,979,515
21	24.0/17	$ 14,769,825	0.3870	$ 5,715,187
22	23.8/17	$ 14,769,825	0.3698	$ 5,462,544
23	23.6/17	$ 14,769,825	0.3535	$ 5,221,070
24	23.4/17	$ 14,769,825	0.3379	$ 4,990,270
25	23.2/17	$ 14,769,825	0.3229	$ 4,769,673
26	23.0/17	$ 14,769,825	0.3087	$ 4,558,827

				$ 208,647,621
		Partial Payment Factor		0.0669

	Present Worth Value			$ 13,958,294
	Rounded Present Worth Value			$ 13,958,300

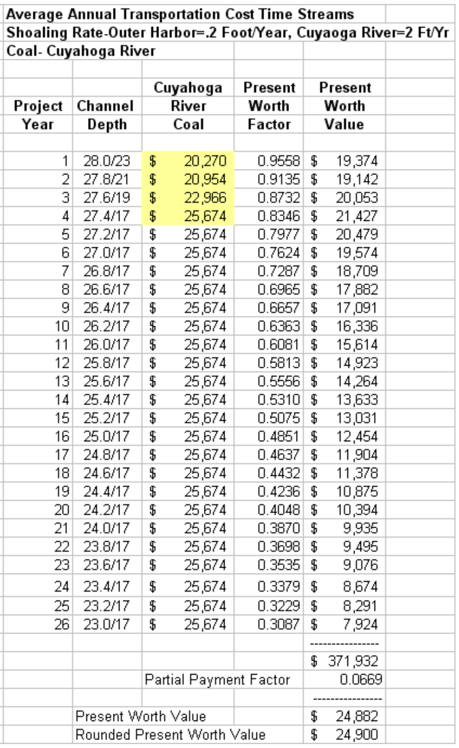


Average Annual Transportation Cost Time Streams
Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=2 Ft/Yr
Cement- Cuyahoga River

Project Year	Channel Depth	Cuyahoga River Cement	Present Worth Factor	Present Worth Value
1	28.0/23	$ 9,971,754	0.9558	$ 9,530,948
2	27.8/21	$ 10,945,535	0.9135	$ 9,999,218
3	27.6/19	$ 12,498,219	0.8732	$ 10,912,939
4	27.4/17	$ 14,809,309	0.8346	$ 12,359,273
5	27.2/17	$ 14,809,309	0.7977	$ 11,812,925
6	27.0/17	$ 14,809,309	0.7624	$ 11,290,729
7	26.8/17	$ 14,809,309	0.7287	$ 10,791,616
8	26.6/17	$ 14,809,309	0.6965	$ 10,314,568
9	26.4/17	$ 14,809,309	0.6657	$ 9,858,607
10	26.2/17	$ 14,809,309	0.6363	$ 9,422,802
11	26.0/17	$ 14,809,309	0.6081	$ 9,006,263
12	25.8/17	$ 14,809,309	0.5813	$ 8,608,136
13	25.6/17	$ 14,809,309	0.5556	$ 8,227,610
14	25.4/17	$ 14,809,309	0.5310	$ 7,863,904
15	25.2/17	$ 14,809,309	0.5075	$ 7,516,276
16	25.0/17	$ 14,809,309	0.4851	$ 7,184,015
17	24.8/17	$ 14,809,309	0.4637	$ 6,866,443
18	24.6/17	$ 14,809,309	0.4432	$ 6,562,908
19	24.4/17	$ 14,809,309	0.4236	$ 6,272,791
20	24.2/17	$ 14,809,309	0.4048	$ 5,995,500
21	24.0/17	$ 14,809,309	0.3870	$ 5,730,466
22	23.8/17	$ 14,809,309	0.3698	$ 5,477,147
23	23.6/17	$ 14,809,309	0.3535	$ 5,235,027
24	23.4/17	$ 14,809,309	0.3379	$ 5,003,610
25	23.2/17	$ 14,809,309	0.3229	$ 4,782,423
26	23.0/17	$ 14,809,309	0.3087	$ 4,571,014

				$ 211,197,158
		Partial Payment Factor		0.0669

	Present Worth Value			$ 14,128,855
	Rounded Present Worth Value			$ 14,128,900



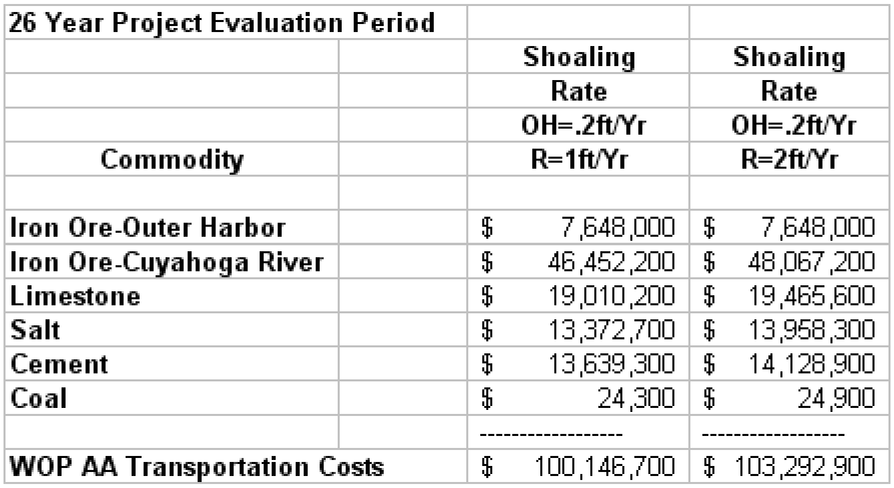
Average Annual Transportation Cost Time Streams
Shoaling Rate-Outer Harbor=.2 Foot/Year, Cuyaoga River=2 Ft/Yr
Coal- Cuyahoga River

Project Year	Channel Depth	Cuyahoga River Coal	Present Worth Factor	Present Worth Value
1	28.0/23	$ 20,270	0.9558	$ 19,374
2	27.8/21	$ 20,954	0.9135	$ 19,142
3	27.6/19	$ 22,966	0.8732	$ 20,053
4	27.4/17	$ 25,674	0.8346	$ 21,427
5	27.2/17	$ 25,674	0.7977	$ 20,479
6	27.0/17	$ 25,674	0.7624	$ 19,574
7	26.8/17	$ 25,674	0.7287	$ 18,709
8	26.6/17	$ 25,674	0.6965	$ 17,882
9	26.4/17	$ 25,674	0.6657	$ 17,091
10	26.2/17	$ 25,674	0.6363	$ 16,336
11	26.0/17	$ 25,674	0.6081	$ 15,614
12	25.8/17	$ 25,674	0.5813	$ 14,923
13	25.6/17	$ 25,674	0.5556	$ 14,264
14	25.4/17	$ 25,674	0.5310	$ 13,633
15	25.2/17	$ 25,674	0.5075	$ 13,031
16	25.0/17	$ 25,674	0.4851	$ 12,454
17	24.8/17	$ 25,674	0.4637	$ 11,904
18	24.6/17	$ 25,674	0.4432	$ 11,378
19	24.4/17	$ 25,674	0.4236	$ 10,875
20	24.2/17	$ 25,674	0.4048	$ 10,394
21	24.0/17	$ 25,674	0.3870	$ 9,935
22	23.8/17	$ 25,674	0.3698	$ 9,495
23	23.6/17	$ 25,674	0.3535	$ 9,076
24	23.4/17	$ 25,674	0.3379	$ 8,674
25	23.2/17	$ 25,674	0.3229	$ 8,291
26	23.0/17	$ 25,674	0.3087	$ 7,924

				$ 371,932
		Partial Payment Factor		0.0669

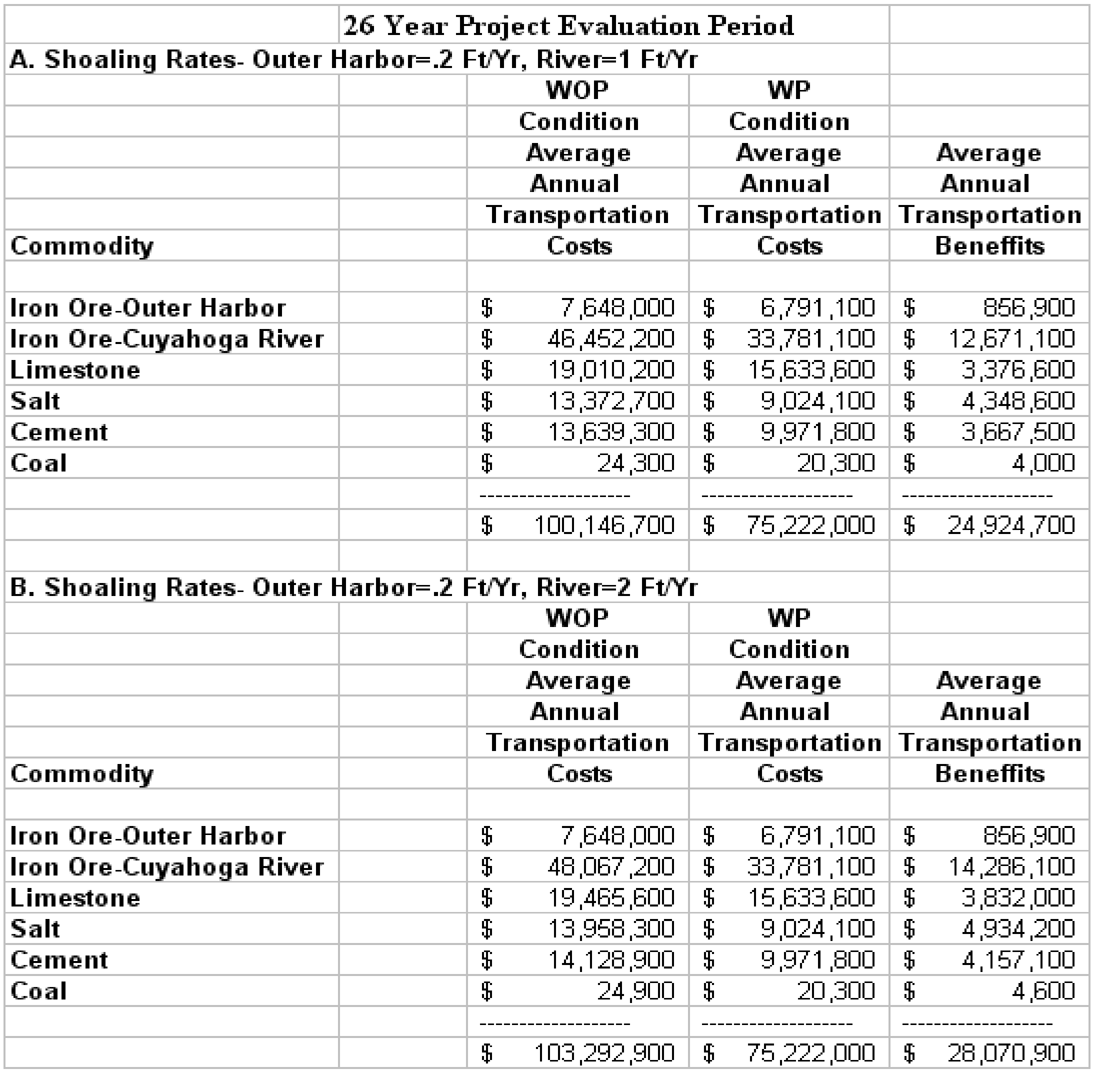
	Present Worth Value			$ 24,882
	Rounded Present Worth Value			$ 24,900

Table 6- Cleveland Harbor WOP Condition Average Annual Vessel Transportation Costs



26 Year Project Evaluation Period			
		Shoaling Rate OH=.2ft/Yr R=1ft/Yr	Shoaling Rate OH=.2ft/Yr R=2ft/Yr
Commodity			
Iron Ore-Outer Harbor		$ 7,648,000	$ 7,648,000
Iron Ore-Cuyahoga River		$ 46,452,200	$ 48,067,200
Limestone		$ 19,010,200	$ 19,465,600
Salt		$ 13,372,700	$ 13,958,300
Cement		$ 13,639,300	$ 14,128,900
Coal		$ 24,300	$ 24,900
		------------------	------------------
WOP AA Transportation Costs		$ 100,146,700	$ 103,292,900

Table 7- Cleveland Harbor Average Annual Harbor Transportation Cost Savings Associated With Maintaining a 28/23 Foot Channel Depth



	26 Year Project Evaluation Period			
A. Shoaling Rates- Outer Harbor=.2 Ft/Yr, River=1 Ft/Yr				
Commodity		WOP Condition Average Annual Transportation Costs	WP Condition Average Annual Transportation Costs	Average Annual Transportation Beneffits
Iron Ore-Outer Harbor		$ 7,648,000	$ 6,791,100	$ 856,900
Iron Ore-Cuyahoga River		$ 46,452,200	$ 33,781,100	$ 12,671,100
Limestone		$ 19,010,200	$ 15,633,600	$ 3,376,600
Salt		$ 13,372,700	$ 9,024,100	$ 4,348,600
Cement		$ 13,639,300	$ 9,971,800	$ 3,667,500
Coal		$ 24,300	$ 20,300	$ 4,000
		-------------------	-------------------	-------------------
		$ 100,146,700	$ 75,222,000	$ 24,924,700
B. Shoaling Rates- Outer Harbor=.2 Ft/Yr, River=2 Ft/Yr				
Commodity		WOP Condition Average Annual Transportation Costs	WP Condition Average Annual Transportation Costs	Average Annual Transportation Beneffits
Iron Ore-Outer Harbor		$ 7,648,000	$ 6,791,100	$ 856,900
Iron Ore-Cuyahoga River		$ 48,067,200	$ 33,781,100	$ 14,286,100
Limestone		$ 19,465,600	$ 15,633,600	$ 3,832,000
Salt		$ 13,958,300	$ 9,024,100	$ 4,934,200
Cement		$ 14,128,900	$ 9,971,800	$ 4,157,100
Coal		$ 24,900	$ 20,300	$ 4,600
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		$ 103,292,900	$ 75,222,000	$ 28,070,900

“Other Recurring Costs” were also identified as well as the frequency of their occurrence. “Other Recurring Costs” include such items as sediment consolidation practices, harbor facility condition inspections/facility surveys, channel soundings, sediment sampling, periodic performance of baseline environmental, economic, and real estate studies, and active solicitation of sediment recycling and beneficial use projects. Table 8 provides these expenditure time streams, by plan, over the 26 year project evaluation period.

These time streams of costs were then brought back to their present worth values using the Federal discount rate of 4.625 percent. The plan evaluation period for this analysis is 26 years, starting in 2009 and ending in 2034. Table 9 provides a summary of this procedure.

These present worth values in Table 9, for the various plans, represent an estimate of project first costs. Interest during construction was added to first costs to arrive at investment costs. (Since benefits accrue immediately, there are no “Interest During Construction” costs). Total investment costs were converted to an average annual basis using the water resources Federal discount rate of 4.625 percent, and a 26 year project life. Annual maintenance costs were calculated as a percentage of contractor earnings and contingencies. Annual maintenance costs were added to average annualized investment costs to arrive at plan average annual costs. Table 10 provides average annual costs by alternative plan.

IV. PLAN EVALUATION- BENEFIT TO COST RATIOS, NET BENEFITS

Table 11 provides benefit cost ratios by alternative plan. The benefit cost ratio is the ratio developed by dividing plan average annual benefits by plan average annual costs. Plan average annual benefits are the difference in average annual transportation costs between the WOP and WP condition. The average annual benefits used for the benefit to cost ratio analysis range from $24,924,700 to $28,070,900.

Alternative Plan costs are the difference in harbor maintenance costs between the WP condition and the WOP condition. Since the WOP condition assumes all harbor maintenance expenditures cease in project year 1, the WOP condition harbor maintenance costs are zero. Thus alternative plan costs equal WP condition average annual costs. Average annual alternative plans costs are provided in Table 10.

Table 11 shows benefit to cost ratios ranging from 1.13 to 1.84. Plan 1, the No Action Plan, has no net benefits and no net costs. Plan 4 has the lowest average annual costs. Thus Plan 4 is the Base Plan. Plan 4 also has the highest net benefits. Thus Plan 4 is also the NED Plan. The usage of a 26 year project evaluation period did not change the relative ranking of the various plans. The benefit to cost ratio for the NED plan ranged from 1.37 to 1.59 using a 20 year project evaluation period (See Appendix G, Part II). The benefit to cost ratio for the NED plan ranged from 1.64 to 1.84 using a 26 year project evaluation period.

Table 8- Time Stream of Plan Costs

Alternative Plan 1- No Action

A. Alternative Plan 1- No Action Plan

Evaluation Period	Calandar Year	Dredging Costs	FMP Dike 12, 9 For 09-14	EIS & NEPA Coordinatio	Develop & Execute PCA	Real Estate	Design Analysis	Construct Mangment Plans & Specs	No Action Facility Costs Bid & Cnstrctn	Fish & Wildlife Mitigation	Best Management Practices Dike 12, 9 New CDF	Annual Harbor Surveys	Annual Channel Soundings	Envrnmntl Studies	Economic Studies	Sediment Sampling	Envrnmntl Compliance	Real Estate Mngmnt	Solicitation Sediment Recycling	Plan 1 Costs In Current Dollars
1	2009	$0	$0		$0	$0	$0	$0			$0	$0	$0	$0	$0				$0	$0
2	2010	$0	$0		$0	$0					$0	$0	$0			$0	$0	$0	$0	$0
3	2011	$0	$0						$0		$0	$0	$0	$0					$0	$0
4	2012	$0	$0						$0		$0	$0	$0						$0	$0
5	2013	$0	$0						$0	$0	$0	$0	$0	$0					$0	$0
6	2014	$0									$0	$0	$0		$0				$0	$0
7	2015	$0									$0	$0	$0	$0		$0	$0	$0	$0	$0
8	2016	$0									$0	$0	$0						$0	$0
9	2017	$0									$0	$0	$0	$0					$0	$0
10	2018	$0									$0	$0	$0						$0	$0
11	2019	$0									$0	$0	$0	$0	$0				$0	$0
12	2020	$0									$0	$0	$0			$0	$0	$0	$0	$0
13	2021	$0									$0	$0	$0	$0					$0	$0
14	2022	$0									$0	$0	$0						$0	$0
15	2023	$0									$0	$0	$0	$0					$0	$0
16	2024	$0									$0	$0	$0		$0				$0	$0
17	2025	$0									$0	$0	$0	$0		$0	$0	$0	$0	$0
18	2026	$0									$0	$0	$0						$0	$0
19	2027	$0									$0	$0	$0						$0	$0
20	2028	$0									$0	$0	$0						$0	$0
21	2029																			
22	2030																			
23	2031																			
24	2032																			
25	2033																			
26	2034																			
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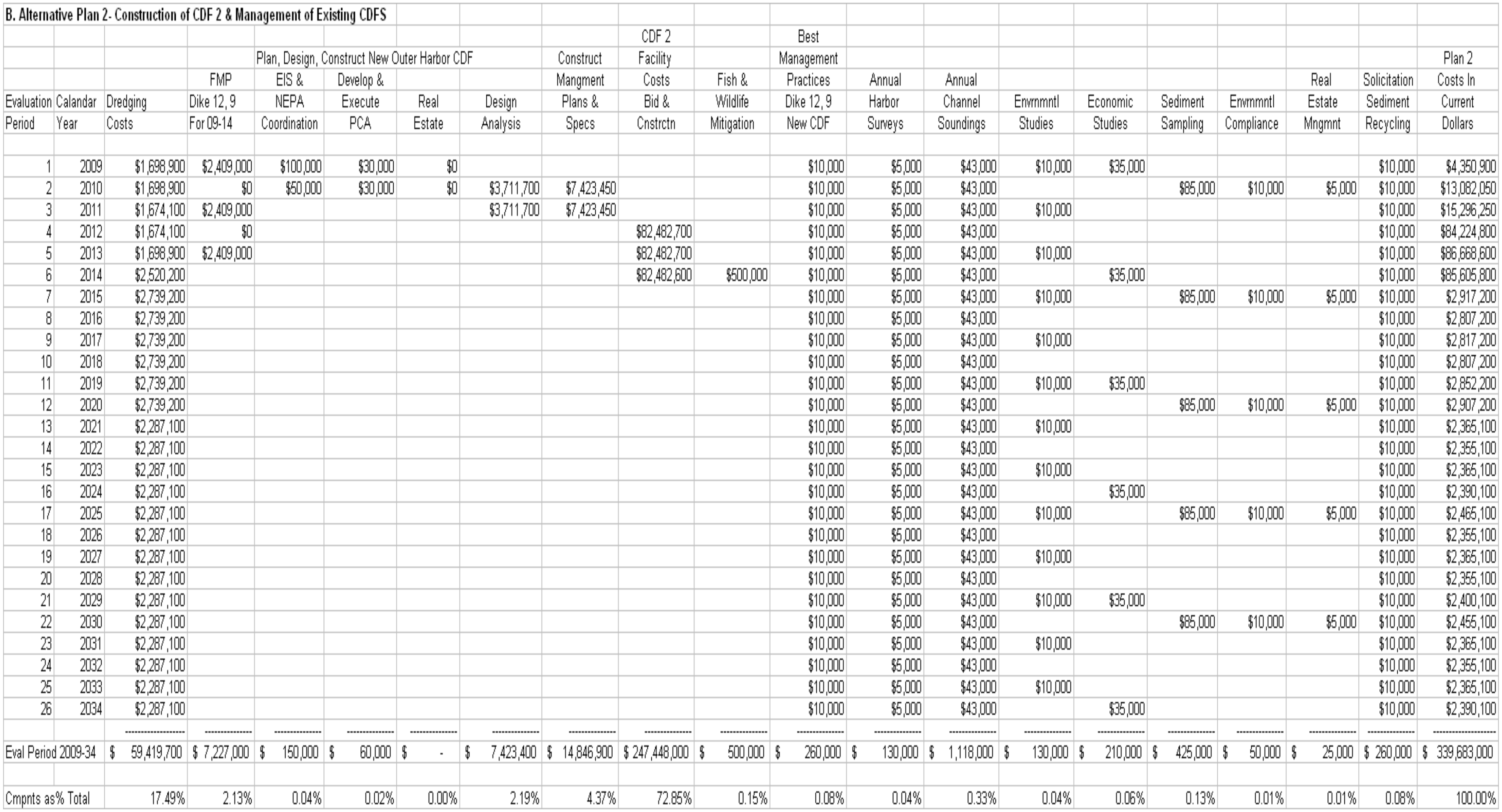
Eval Period 2009-34		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cmpnts as% Total		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Table 8- Time Stream of Plan Costs

Alternative Plan 2-



B. Alternative Plan 2- Construction of CDF 2 & Management of Existing CDFS																				
				Plan, Design, Construct New Outer Harbor CDF																
Evaluation Period	Calandar Year	Dredging Costs	FMP Dike 12, 9 For 09-14	EIS & NEPA Coordination	Develop & Execute PCA	Real Estate	Design Analysis	Construct Mangment Plans & Specs	CDF 2 Facility Costs Bid & Cnstrctn	Fish & Wildlife Mitigation	Best Management Practices Dike 12, 9 New CDF	Annual Harbor Surveys	Annual Channel Soundings	Envrnmntl Studies	Economic Studies	Sediment Sampling	Envrnmntl Compliance	Real Estate Mngmnt	Solicitation Sediment Recycling	Plan 2 Costs In Current Dollars
1	2009	$1,698,900	$2,409,000	$100,000	$30,000	$0					$10,000	$5,000	$43,000	$10,000	$35,000				$10,000	$4,350,900
2	2010	$1,698,900	$0	$50,000	$30,000	$0	$3,711,700	$7,423,450			$10,000	$5,000	$43,000			$85,000	$10,000	$5,000	$10,000	$13,082,050
3	2011	$1,674,100	$2,409,000				$3,711,700	$7,423,450			$10,000	$5,000	$43,000	$10,000					$10,000	$15,296,250
4	2012	$1,674,100	$0						$82,482,700		$10,000	$5,000	$43,000						$10,000	$84,224,800
5	2013	$1,698,900	$2,409,000						$82,482,700		$10,000	$5,000	$43,000	$10,000					$10,000	$86,668,600
6	2014	$2,520,200							$82,482,600	$500,000	$10,000	$5,000	$43,000		$35,000				$10,000	$85,605,800
7	2015	$2,739,200									$10,000	$5,000	$43,000	$10,000		$85,000	$10,000	$5,000	$10,000	$2,917,200
8	2016	$2,739,200									$10,000	$5,000	$43,000						$10,000	$2,807,200
9	2017	$2,739,200									$10,000	$5,000	$43,000	$10,000					$10,000	$2,817,200
10	2018	$2,739,200									$10,000	$5,000	$43,000						$10,000	$2,807,200
11	2019	$2,739,200									$10,000	$5,000	$43,000	$10,000	$35,000				$10,000	$2,852,200
12	2020	$2,739,200									$10,000	$5,000	$43,000			$85,000	$10,000	$5,000	$10,000	$2,907,200
13	2021	$2,287,100									$10,000	$5,000	$43,000	$10,000					$10,000	$2,365,100
14	2022	$2,287,100									$10,000	$5,000	$43,000						$10,000	$2,355,100
15	2023	$2,287,100									$10,000	$5,000	$43,000	$10,000					$10,000	$2,365,100
16	2024	$2,287,100									$10,000	$5,000	$43,000		$35,000				$10,000	$2,390,100
17	2025	$2,287,100									$10,000	$5,000	$43,000	$10,000		$85,000	$10,000	$5,000	$10,000	$2,465,100
18	2026	$2,287,100									$10,000	$5,000	$43,000						$10,000	$2,355,100
19	2027	$2,287,100									$10,000	$5,000	$43,000	$10,000					$10,000	$2,365,100
20	2028	$2,287,100									$10,000	$5,000	$43,000						$10,000	$2,355,100
21	2029	$2,287,100									$10,000	$5,000	$43,000	$10,000	$35,000				$10,000	$2,400,100
22	2030	$2,287,100									$10,000	$5,000	$43,000			$85,000	$10,000	$5,000	$10,000	$2,455,100
23	2031	$2,287,100									$10,000	$5,000	$43,000	$10,000					$10,000	$2,365,100
24	2032	$2,287,100									$10,000	$5,000	$43,000						$10,000	$2,355,100
25	2033	$2,287,100									$10,000	$5,000	$43,000	$10,000					$10,000	$2,365,100
26	2034	$2,287,100									$10,000	$5,000	$43,000		$35,000				$10,000	$2,390,100
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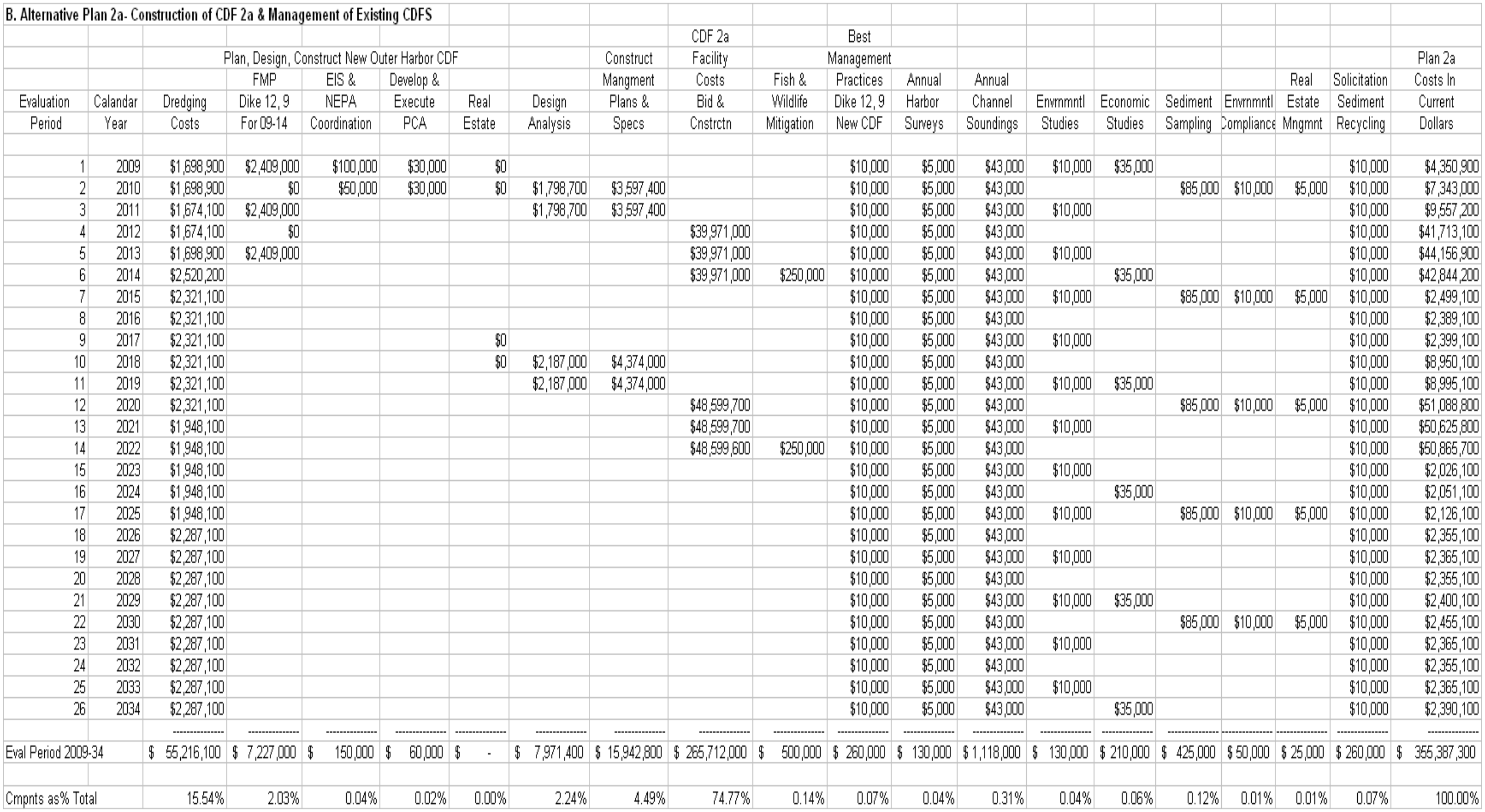
Eval Period 2009-34		$ 59,419,700	$ 7,227,000	$ 150,000	$ 60,000	$ -	$ 7,423,400	$ 14,846,900	$ 247,448,000	$ 500,000	$ 260,000	$ 130,000	$ 1,118,000	$ 130,000	$ 210,000	$ 425,000	$ 50,000	$ 25,000	$ 260,000	$ 339,683,000
Cmpnts as% Total		17.49%	2.13%	0.04%	0.02%	0.00%	2.19%	4.37%	72.85%	0.15%	0.08%	0.04%	0.33%	0.04%	0.06%	0.13%	0.01%	0.01%	0.08%	100.00%

Table 8- Time Stream of Plan Costs

Alternative Plan 2a-



B. Alternative Plan 2a- Construction of CDF 2a & Management of Existing CDFS																				
			Plan, Design, Construct New Outer Harbor CDF																	
Evaluation Period	Calandar Year	Dredging Costs	FMP Dike 12, 9 For 09-14	EIS & NEPA Coordination	Develop & Execute PCA	Real Estate	Design Analysis	Construct Mangment Plans & Specs	CDF 2a Facility Costs Bid & Cnstrctn	Fish & Wildlife Mitigation	Best Management Practices Dike 12, 9 New CDF	Annual Harbor Surveys	Annual Channel Soundings	Envrnmntl Studies	Economic Studies	Sediment Sampling	Envrnmntl Compliance	Real Estate Mngmnt	Solicitation Sediment Recycling	Plan 2a Costs In Current Dollars
1	2009	$1,698,900	$2,409,000	$100,000	$30,000	$0					$10,000	$5,000	$43,000	$10,000	$35,000				$10,000	$4,350,900
2	2010	$1,698,900	$0	$50,000	$30,000	$0	$1,798,700	$3,597,400			$10,000	$5,000	$43,000			$85,000	$10,000	$5,000	$10,000	$7,343,000
3	2011	$1,674,100	$2,409,000				$1,798,700	$3,597,400			$10,000	$5,000	$43,000	$10,000					$10,000	$9,557,200
4	2012	$1,674,100	$0						$39,971,000		$10,000	$5,000	$43,000						$10,000	$41,713,100
5	2013	$1,698,900	$2,409,000						$39,971,000		$10,000	$5,000	$43,000	$10,000					$10,000	$44,156,900
6	2014	$2,520,200							$39,971,000	$250,000	$10,000	$5,000	$43,000		$35,000				$10,000	$42,844,200
7	2015	$2,321,100									$10,000	$5,000	$43,000	$10,000		$85,000	$10,000	$5,000	$10,000	$2,499,100
8	2016	$2,321,100									$10,000	$5,000	$43,000						$10,000	$2,389,100
9	2017	$2,321,100				$0					$10,000	$5,000	$43,000	$10,000					$10,000	$2,399,100
10	2018	$2,321,100				$0	$2,187,000	$4,374,000			$10,000	$5,000	$43,000						$10,000	$8,950,100
11	2019	$2,321,100					$2,187,000	$4,374,000			$10,000	$5,000	$43,000	$10,000	$35,000				$10,000	$8,995,100
12	2020	$2,321,100							$48,599,700		$10,000	$5,000	$43,000			$85,000	$10,000	$5,000	$10,000	$51,088,800
13	2021	$1,948,100							$48,599,700		$10,000	$5,000	$43,000	$10,000					$10,000	$50,625,800
14	2022	$1,948,100							$48,599,600	$250,000	$10,000	$5,000	$43,000						$10,000	$50,865,700
15	2023	$1,948,100									$10,000	$5,000	$43,000	$10,000					$10,000	$2,026,100
16	2024	$1,948,100									$10,000	$5,000	$43,000		$35,000				$10,000	$2,051,100
17	2025	$1,948,100									$10,000	$5,000	$43,000	$10,000		$85,000	$10,000	$5,000	$10,000	$2,126,100
18	2026	$2,287,100									$10,000	$5,000	$43,000						$10,000	$2,355,100
19	2027	$2,287,100									$10,000	$5,000	$43,000	$10,000					$10,000	$2,365,100
20	2028	$2,287,100									$10,000	$5,000	$43,000						$10,000	$2,355,100
21	2029	$2,287,100									$10,000	$5,000	$43,000	$10,000	$35,000				$10,000	$2,400,100
22	2030	$2,287,100									$10,000	$5,000	$43,000			$85,000	$10,000	$5,000	$10,000	$2,455,100
23	2031	$2,287,100									$10,000	$5,000	$43,000	$10,000					$10,000	$2,365,100
24	2032	$2,287,100									$10,000	$5,000	$43,000						$10,000	$2,355,100
25	2033	$2,287,100									$10,000	$5,000	$43,000	$10,000					$10,000	$2,365,100
26	2034	$2,287,100									$10,000	$5,000	$43,000		$35,000				$10,000	$2,390,100
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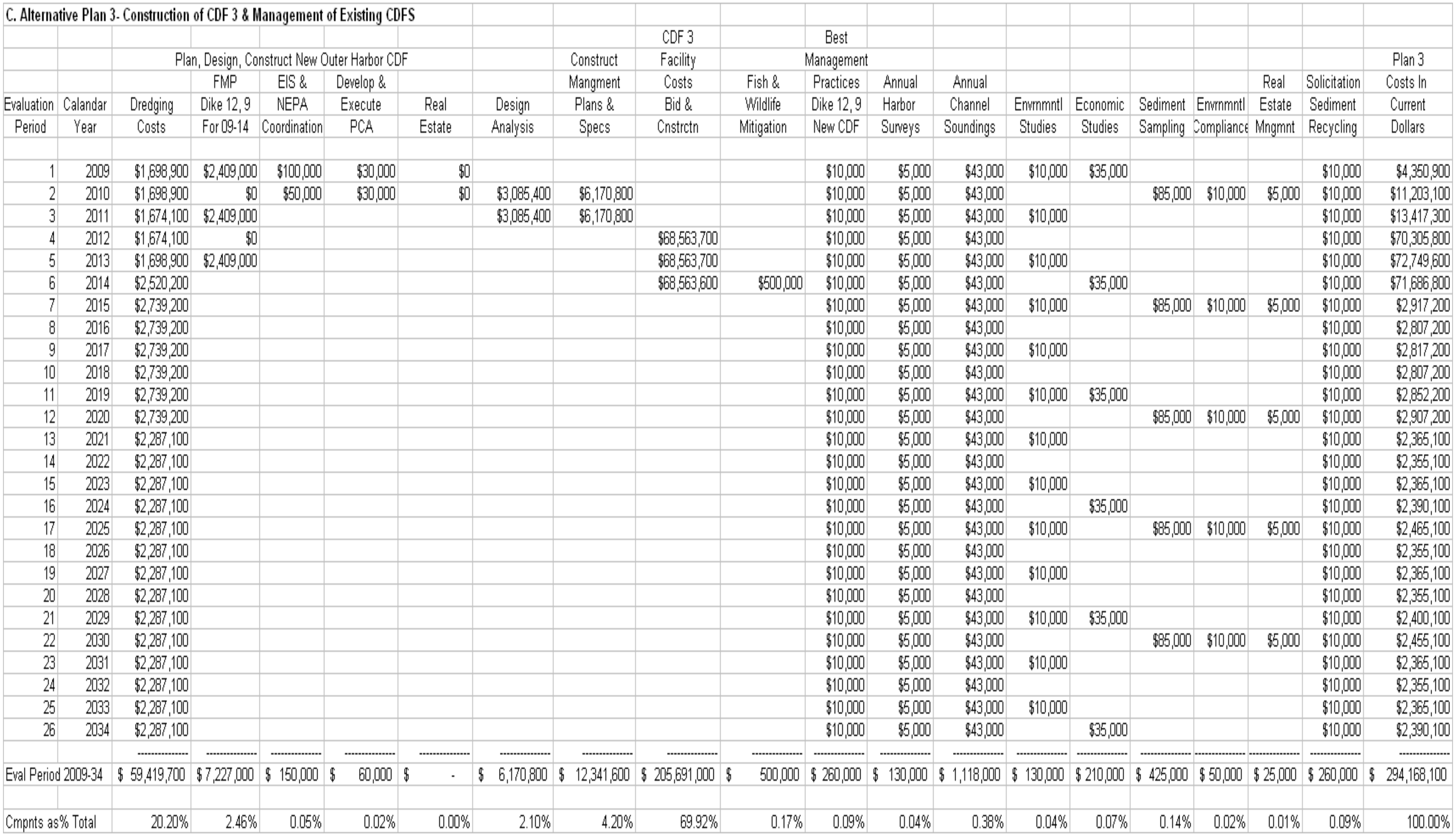
Eval Period 2009-34		$ 55,216,100	$ 7,227,000	$ 150,000	$ 60,000	$ -	$ 7,971,400	$ 15,942,800	$ 265,712,000	$ 500,000	$ 260,000	$ 130,000	$ 1,118,000	$ 130,000	$ 210,000	$ 425,000	$ 50,000	$ 25,000	$ 260,000	$ 355,387,300
Cmpnts as% Total		15.54%	2.03%	0.04%	0.02%	0.00%	2.24%	4.49%	74.77%	0.14%	0.07%	0.04%	0.31%	0.04%	0.06%	0.12%	0.01%	0.01%	0.07%	100.00%

Table 8- Time Stream of Plan Costs

Alternative Plan 3-



C. Alternative Plan 3- Construction of CDF 3 & Management of Existing CDFS

		Plan, Design, Construct New Outer Harbor CDF																		
Evaluation Period	Calandar Year	Dredging Costs	FMP Dike 12, 9 For 09-14	EIS & NEPA Coordination	Develop & Execute PCA	Real Estate	Design Analysis	Construct Mangment Plans & Specs	CDF 3 Facility Costs Bid & Cnstrctn	Fish & Wildlife Mitigation	Best Management Practices Dike 12, 9 New CDF	Annual Harbor Surveys	Annual Channel Soundings	Envrnmntl Studies	Economic Studies	Sediment Sampling	Envrnmntl Compliance	Real Estate Mngmnt	Solicitation Sediment Recycling	Plan 3 Costs In Current Dollars
1	2009	$1,698,900	$2,409,000	$100,000	$30,000	$0					$10,000	$5,000	$43,000	$10,000	$35,000				$10,000	$4,350,900
2	2010	$1,698,900	$0	$50,000	$30,000	$0	$3,085,400	$6,170,800			$10,000	$5,000	$43,000			$85,000	$10,000	$5,000	$10,000	$11,203,100
3	2011	$1,674,100	$2,409,000				$3,085,400	$6,170,800			$10,000	$5,000	$43,000	$10,000					$10,000	$13,417,300
4	2012	$1,674,100	$0						$68,563,700		$10,000	$5,000	$43,000						$10,000	$70,305,800
5	2013	$1,698,900	$2,409,000						$68,563,700		$10,000	$5,000	$43,000	$10,000					$10,000	$72,749,600
6	2014	$2,520,200							$68,563,600	$500,000	$10,000	$5,000	$43,000		$35,000				$10,000	$71,686,800
7	2015	$2,739,200									$10,000	$5,000	$43,000	$10,000		$85,000	$10,000	$5,000	$10,000	$2,917,200
8	2016	$2,739,200									$10,000	$5,000	$43,000						$10,000	$2,807,200
9	2017	$2,739,200									$10,000	$5,000	$43,000	$10,000					$10,000	$2,817,200
10	2018	$2,739,200									$10,000	$5,000	$43,000						$10,000	$2,807,200
11	2019	$2,739,200									$10,000	$5,000	$43,000	$10,000	$35,000				$10,000	$2,852,200
12	2020	$2,739,200									$10,000	$5,000	$43,000			$85,000	$10,000	$5,000	$10,000	$2,907,200
13	2021	$2,287,100									$10,000	$5,000	$43,000	$10,000					$10,000	$2,365,100
14	2022	$2,287,100									$10,000	$5,000	$43,000						$10,000	$2,355,100
15	2023	$2,287,100									$10,000	$5,000	$43,000	$10,000					$10,000	$2,365,100
16	2024	$2,287,100									$10,000	$5,000	$43,000		$35,000				$10,000	$2,390,100
17	2025	$2,287,100									$10,000	$5,000	$43,000	$10,000		$85,000	$10,000	$5,000	$10,000	$2,465,100
18	2026	$2,287,100									$10,000	$5,000	$43,000						$10,000	$2,355,100
19	2027	$2,287,100									$10,000	$5,000	$43,000	$10,000					$10,000	$2,365,100
20	2028	$2,287,100									$10,000	$5,000	$43,000						$10,000	$2,355,100
21	2029	$2,287,100									$10,000	$5,000	$43,000	$10,000	$35,000				$10,000	$2,400,100
22	2030	$2,287,100									$10,000	$5,000	$43,000			$85,000	$10,000	$5,000	$10,000	$2,455,100
23	2031	$2,287,100									$10,000	$5,000	$43,000	$10,000					$10,000	$2,365,100
24	2032	$2,287,100									$10,000	$5,000	$43,000						$10,000	$2,355,100
25	2033	$2,287,100									$10,000	$5,000	$43,000	$10,000					$10,000	$2,365,100
26	2034	$2,287,100									$10,000	$5,000	$43,000		$35,000				$10,000	$2,390,100
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Eval Period 2009-34		$ 59,419,700	$ 7,227,000	$ 150,000	$ 60,000	$ -	$ 6,170,800	$ 12,341,600	$ 205,691,000	$ 500,000	$ 260,000	$ 130,000	$ 1,118,000	$ 130,000	$ 210,000	$ 425,000	$ 50,000	$ 25,000	$ 260,000	$ 294,168,100
Cmpnts as% Total		20.20%	2.46%	0.05%	0.02%	0.00%	2.10%	4.20%	69.92%	0.17%	0.09%	0.04%	0.38%	0.04%	0.07%	0.14%	0.02%	0.01%	0.09%	100.00%

Table 8- Time Stream of Plan Costs

Alternative Plan 3a-

C. Alternative Plan 3a- Construction of CDF 3a & Management of Existing CDFS																				
		Plan, Design, Construct New Outer Harbor CDF																		
Evaluation Period	Calandar Year	Dredging Costs	FMP Dike 12, 9 For 09-14	EIS & NEPA Coordination	Develop & Execute PCA	Real Estate	Design Analysis	Construct Mangment Plans & Specs	CDF 3a Facility Costs Bid & Cnstrctn	Fish & Wildlife Mitigation	Best Management Practices Dike 12, 9 New CDF	Annual Harbor Surveys	Annual Channel Soundings	Envrnmntl Studies	Economic Studies	Sediment Sampling	Envrnmntl Compliance	Real Estate Mngmnt	Solicitation Sediment Recycling	Plan 3a Costs In Current Dollars
1	2009	$1,698,900	$2,409,000	$100,000	$30,000	$0					$10,000	$5,000	$43,000	$10,000	$35,000				$10,000	$4,350,900
2	2010	$1,698,900	$0	$50,000	$30,000	$0	$2,081,850	$4,163,650			$10,000	$5,000	$43,000			$85,000	$10,000	$5,000	$10,000	$8,192,400
3	2011	$1,674,100	$2,409,000				$2,081,850	$4,163,650			$10,000	$5,000	$43,000	$10,000					$10,000	$10,406,600
4	2012	$1,674,100	$0						$46,263,000		$10,000	$5,000	$43,000						$10,000	$48,005,100
5	2013	$1,698,900	$2,409,000						$46,263,000		$10,000	$5,000	$43,000	$10,000					$10,000	$50,448,900
6	2014	$2,520,200				$0			$46,263,000	$250,000	$10,000	$5,000	$43,000		$35,000				$10,000	$49,136,200
7	2015	$2,360,900				$0	$3,023,300	$6,046,500			$10,000	$5,000	$43,000	$10,000		$85,000	$10,000	$5,000	$10,000	$11,608,700
8	2016	$2,360,900					$3,023,300	$6,046,500			$10,000	$5,000	$43,000						$10,000	$11,498,700
9	2017	$2,360,900							$67,183,300		$10,000	$5,000	$43,000	$10,000					$10,000	$69,622,200
10	2018	$2,360,900							$67,183,300		$10,000	$5,000	$43,000						$10,000	$69,612,200
11	2019	$2,360,900							$67,183,400	$250,000	$10,000	$5,000	$43,000	$10,000	$35,000				$10,000	$69,907,300
12	2020	$2,360,900									$10,000	$5,000	$43,000			$85,000	$10,000	$5,000	$10,000	$2,528,900
13	2021	$1,980,400									$10,000	$5,000	$43,000	$10,000					$10,000	$2,058,400
14	2022	$1,980,400									$10,000	$5,000	$43,000						$10,000	$2,048,400
15	2023	$1,980,400									$10,000	$5,000	$43,000	$10,000					$10,000	$2,058,400
16	2024	$1,980,400									$10,000	$5,000	$43,000		$35,000				$10,000	$2,083,400
17	2025	$1,980,400									$10,000	$5,000	$43,000	$10,000		$85,000	$10,000	$5,000	$10,000	$2,158,400
18	2026	$2,287,100									$10,000	$5,000	$43,000						$10,000	$2,355,100
19	2027	$2,287,100									$10,000	$5,000	$43,000	$10,000					$10,000	$2,365,100
20	2028	$2,287,100									$10,000	$5,000	$43,000						$10,000	$2,355,100
21	2029	$2,287,100									$10,000	$5,000	$43,000	$10,000	$35,000				$10,000	$2,400,100
22	2030	$2,287,100									$10,000	$5,000	$43,000			$85,000	$10,000	$5,000	$10,000	$2,455,100
23	2031	$2,287,100									$10,000	$5,000	$43,000	$10,000					$10,000	$2,365,100
24	2032	$2,287,100									$10,000	$5,000	$43,000						$10,000	$2,355,100
25	2033	$2,287,100									$10,000	$5,000	$43,000	$10,000					$10,000	$2,365,100
26	2034	$2,287,100									$10,000	$5,000	$43,000		$35,000				$10,000	$2,390,100
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Eval Period 2009-34		$ 55,616,400	$ 7,227,000	$ 150,000	$ 60,000	$ -	$ 10,210,300	$ 20,420,300	$ 340,339,000	$ 500,000	$ 260,000	$ 130,000	$ 1,118,000	$ 130,000	$ 210,000	$ 425,000	$ 50,000	$ 25,000	$ 260,000	$ 437,131,000
Cmpnts as% Total		12.72%	1.65%	0.03%	0.01%	0.00%	2.34%	4.67%	77.86%	0.11%	0.06%	0.03%	0.26%	0.03%	0.05%	0.10%	0.01%	0.01%	0.06%	100.00%

Table 8- Time Stream of Plan Costs

Alternative Plan 4-

D. Alternative Plan 4- Construction of CDF 9-E 55th St & Management of Existing CDFS- Corps Configuation BTBOC																				
									CDF 4-E 55th St.		Best									
			Plan, Design, Construct New Outer Harbor CDF					Construct	Facility		Management									Plan 4- E 55th
			FMP	EIS &	Develop &			Mangment	Costs	Fish &	Practices	Annual	Annual					Real	Solicitation	Costs In
Evaluation	Calandar	Dredging	Dike 12, 9	NEPA	Execute	Real	Design	Plans &	Bid &	Wildlife	Dike 12, 9	Harbor	Channel	Envrnmntl	Economic	Sediment	Envrnmntl	Estate	Sediment	Current
Period	Year	Costs	For 09-14	Coordination	PCA	Estate	Analysis	Specs	Cnstrctn	Mitigation	New CDF	Surveys	Soundings	Studies	Studies	Sampling	Compliance	Mngmnt	Recycling	Dollars
1	2009	$1,698,900	$2,409,000	$100,000	$30,000	$22,500					$10,000	$5,000	$43,000	$10,000	$35,000				$10,000	$4,373,400
2	2010	$1,698,900	$0	$50,000	$30,000	$22,500	$1,656,750	$3,313,500			$10,000	$5,000	$43,000			$85,000	$10,000	$5,000	$10,000	$6,939,650
3	2011	$1,674,100	$2,409,000				$1,656,750	$3,313,500			$10,000	$5,000	$43,000	$10,000					$10,000	$9,131,350
4	2012	$1,674,100	$0						$36,816,700		$10,000	$5,000	$43,000						$10,000	$38,558,800
5	2013	$1,698,900	$2,409,000						$36,816,700		$10,000	$5,000	$43,000	$10,000					$10,000	$41,002,600
6	2014	$2,520,200							$36,816,600	$ 166,700	$10,000	$5,000	$43,000		$35,000				$10,000	$39,606,500
7	2015	$2,599,800									$10,000	$5,000	$43,000	$10,000		$85,000	$10,000	$5,000	$10,000	$2,777,800
8	2016	$2,599,800									$10,000	$5,000	$43,000						$10,000	$2,667,800
9	2017	$2,599,800					$811,400	$1,622,800			$10,000	$5,000	$43,000	$10,000					$10,000	$5,112,000
10	2018	$2,599,800					$811,400	$1,622,800			$10,000	$5,000	$43,000						$10,000	$5,102,000
11	2019	$2,599,800							$18,030,300		$10,000	$5,000	$43,000	$10,000	$35,000				$10,000	$20,743,100
12	2020	$2,599,800							$18,030,300		$10,000	$5,000	$43,000			$85,000	$10,000	$5,000	$10,000	$20,798,100
13	2021	$2,174,100							$18,030,400	$ 166,700	$10,000	$5,000	$43,000	$10,000					$10,000	$20,449,200
14	2022	$2,141,800					$1,100,800	$2,201,700			$10,000	$5,000	$43,000						$10,000	$5,512,300
15	2023	$2,141,800					$1,100,800	$2,201,700			$10,000	$5,000	$43,000	$10,000					$10,000	$5,522,300
16	2024	$2,141,800							$24,462,700		$10,000	$5,000	$43,000		$35,000				$10,000	$26,707,500
17	2025	$2,141,800							$24,462,700		$10,000	$5,000	$43,000	$10,000		$85,000	$10,000	$5,000	$10,000	$26,782,500
18	2026	$2,141,800							$24,462,600	$ 166,600	$10,000	$5,000	$43,000						$10,000	$26,839,000
19	2027	$2,141,800									$10,000	$5,000	$43,000	$10,000					$10,000	$2,219,800
20	2028	$2,141,800									$10,000	$5,000	$43,000						$10,000	$2,209,800
21	2029	$2,141,800									$10,000	$5,000	$43,000	$10,000	$35,000				$10,000	$2,254,800
22	2030	$2,141,800									$10,000	$5,000	$43,000			$85,000	$10,000	$5,000	$10,000	$2,309,800
23	2031	$2,141,800									$10,000	$5,000	$43,000	$10,000					$10,000	$2,219,800
24	2032	$2,141,800									$10,000	$5,000	$43,000						$10,000	$2,209,800
25	2033	$2,141,800									$10,000	$5,000	$43,000	$10,000					$10,000	$2,219,800
26	2034	$2,141,800									$10,000	$5,000	$43,000		$35,000				$10,000	$2,244,800
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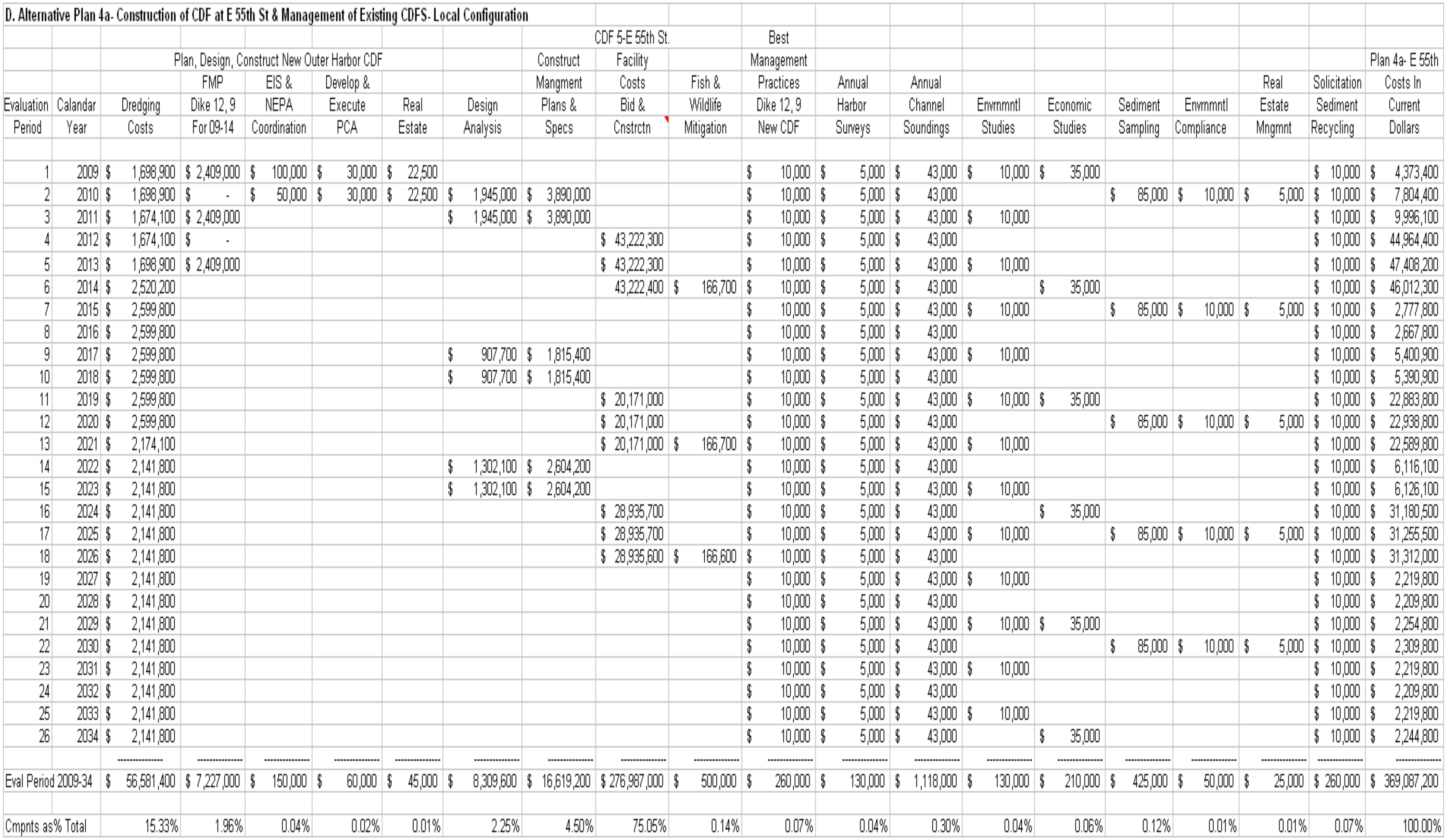
Eval Period 2009-34		$56,581,400	$7,227,000	$150,000	$60,000	$45,000	$7,137,900	$14,276,000	$237,929,000	$500,000	$260,000	$130,000	$1,118,000	$130,000	$210,000	$425,000	$50,000	$25,000	$260,000	$326,514,300
Cmpnts as% Total		17.33%	2.21%	0.05%	0.02%	0.01%	2.19%	4.37%	72.87%	0.15%	0.08%	0.04%	0.34%	0.04%	0.06%	0.13%	0.02%	0.01%	0.08%	100.00%

Table 8- Time Stream of Plan Costs

Alternative Plan 4a-



D. Alternative Plan 4a- Construction of CDF at E 55th St & Management of Existing CDFS- Local Configuration																				
		Plan, Design, Construct New Outer Harbor CDF																		
Evaluation Period	Calandar Year	Dredging Costs	FMP Dike 12, 9 For 09-14	EIS & NEPA Coordination	Develop & Execute PCA	Real Estate	Design Analysis	Construct Mangment Plans & Specs	CDF 5-E 55th St. Facility Costs Bid & Cnstrctn	Fish & Wildlife Mitigation	Best Management Practices Dike 12, 9 New CDF	Annual Harbor Surveys	Annual Channel Soundings	Envrnmntl Studies	Economic Studies	Sediment Sampling	Envrnmntl Compliance	Real Estate Mngmnt	Solicitation Sediment Recycling	Plan 4a- E 55th Costs In Current Dollars
1	2009	$ 1,698,900	$ 2,409,000	$ 100,000	$ 30,000	$ 22,500					$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 4,373,400
2	2010	$ 1,698,900	$ -	$ 50,000	$ 30,000	$ 22,500	$ 1,945,000	$ 3,890,000			$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 7,804,400
3	2011	$ 1,674,100	$ 2,409,000				$ 1,945,000	$ 3,890,000			$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 9,996,100
4	2012	$ 1,674,100	$ -						$ 43,222,300		$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 44,964,400
5	2013	$ 1,698,900	$ 2,409,000						$ 43,222,300		$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 47,408,200
6	2014	$ 2,520,200							43,222,400	$ 166,700	$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 46,012,300
7	2015	$ 2,599,800									$ 10,000	$ 5,000	$ 43,000	$ 10,000		$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,777,800
8	2016	$ 2,599,800									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,667,800
9	2017	$ 2,599,800					$ 907,700	$ 1,815,400			$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 5,400,900
10	2018	$ 2,599,800					$ 907,700	$ 1,815,400			$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 5,390,900
11	2019	$ 2,599,800							$ 20,171,000		$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 22,883,800
12	2020	$ 2,599,800							$ 20,171,000		$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 22,938,800
13	2021	$ 2,174,100							$ 20,171,000	$ 166,700	$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 22,589,800
14	2022	$ 2,141,800					$ 1,302,100	$ 2,604,200			$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 6,116,100
15	2023	$ 2,141,800					$ 1,302,100	$ 2,604,200			$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 6,126,100
16	2024	$ 2,141,800							$ 28,935,700		$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 31,180,500
17	2025	$ 2,141,800							$ 28,935,700		$ 10,000	$ 5,000	$ 43,000	$ 10,000		$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 31,255,500
18	2026	$ 2,141,800							$ 28,935,600	$ 166,600	$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 31,312,000
19	2027	$ 2,141,800									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,219,800
20	2028	$ 2,141,800									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,209,800
21	2029	$ 2,141,800									$ 10,000	$ 5,000	$ 43,000	$ 10,000	$ 35,000				$ 10,000	$ 2,254,800
22	2030	$ 2,141,800									$ 10,000	$ 5,000	$ 43,000			$ 85,000	$ 10,000	$ 5,000	$ 10,000	$ 2,309,800
23	2031	$ 2,141,800									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,219,800
24	2032	$ 2,141,800									$ 10,000	$ 5,000	$ 43,000						$ 10,000	$ 2,209,800
25	2033	$ 2,141,800									$ 10,000	$ 5,000	$ 43,000	$ 10,000					$ 10,000	$ 2,219,800
26	2034	$ 2,141,800									$ 10,000	$ 5,000	$ 43,000		$ 35,000				$ 10,000	$ 2,244,800
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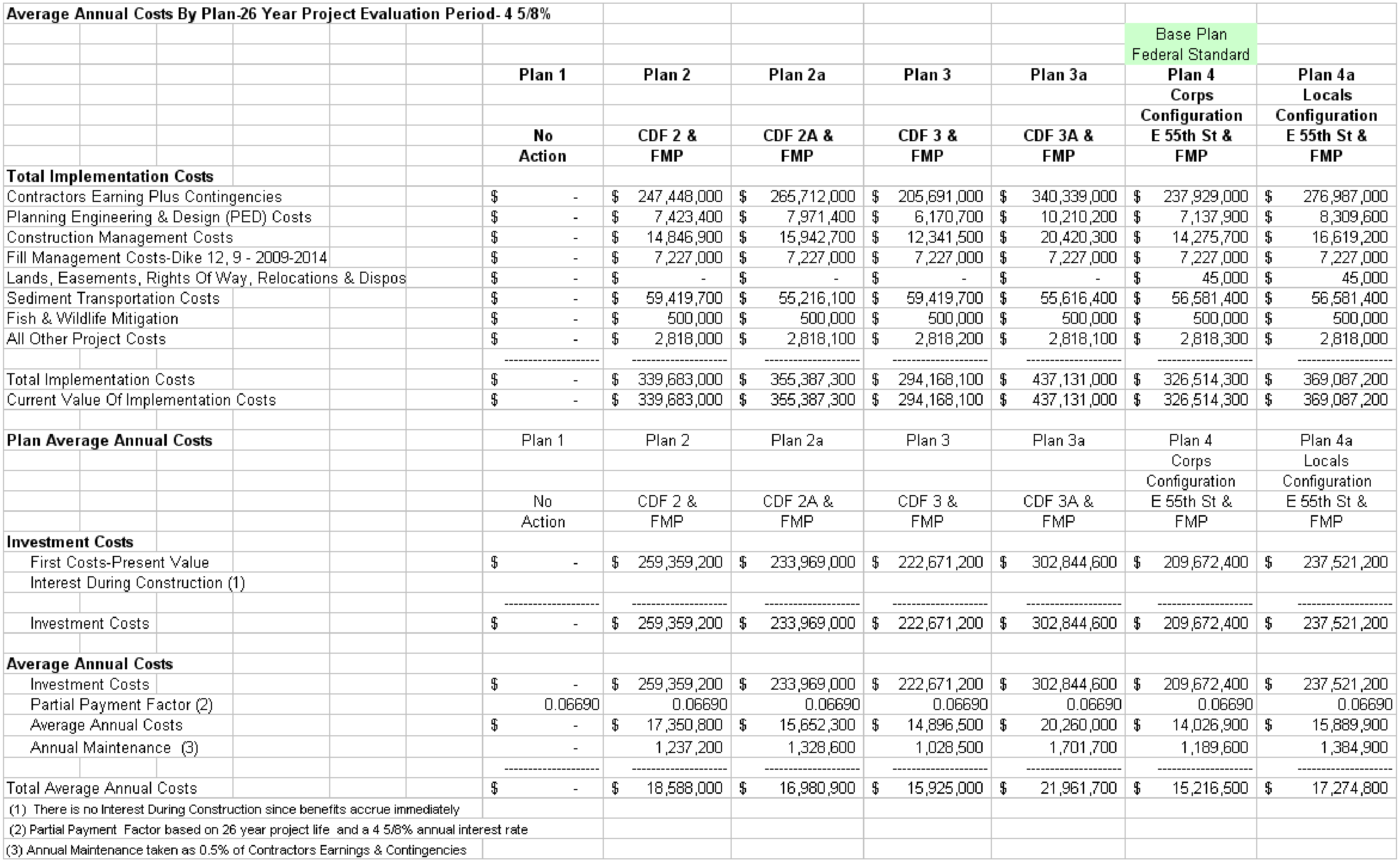
Eval Period 2009-34		$ 56,581,400	$ 7,227,000	$ 150,000	$ 60,000	$ 45,000	$ 8,309,600	$ 16,619,200	$ 276,987,000	$ 500,000	$ 260,000	$ 130,000	$ 1,118,000	$ 130,000	$ 210,000	$ 425,000	$ 50,000	$ 25,000	$ 260,000	$ 369,087,200
Cmpnts as% Total		15.33%	1.96%	0.04%	0.02%	0.01%	2.25%	4.50%	75.05%	0.14%	0.07%	0.04%	0.30%	0.04%	0.06%	0.12%	0.01%	0.01%	0.07%	100.00%

Table 9- Present Worth Of Plan Costs- Plan 1, 2, 2a, 3, 3a, 4, 4a

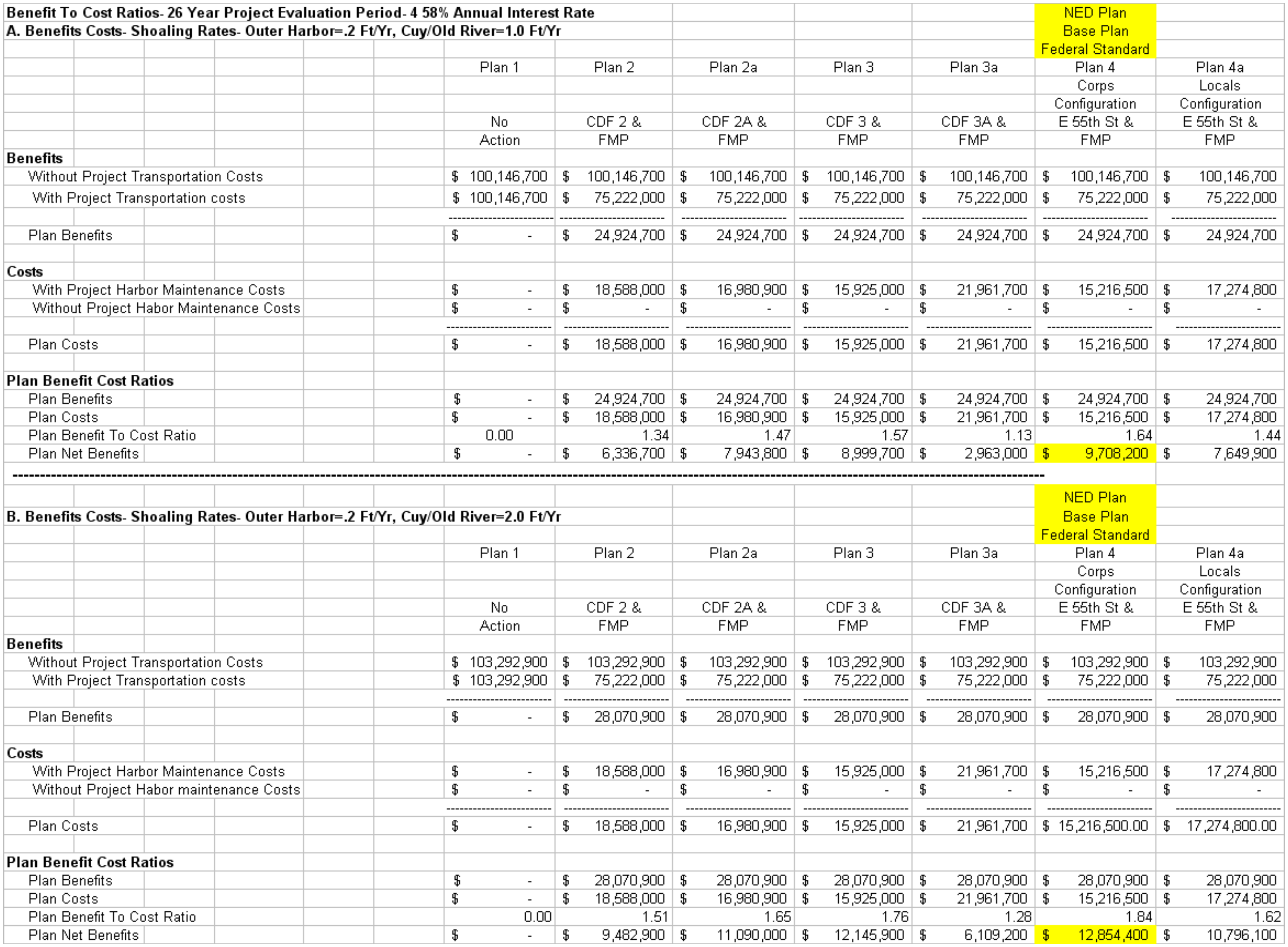
		Plan Costs In Current Dollars								Plan Costs In Present Worth Dollars						
Evaluation Period	Calandar Year	Plan 1 (No Action)	Plan 2 (Site 2)	Plan 2a (Site 2a)	Plan 3 (Site 3)	Plan 3a (Site 3a)	Federal Standard Corps Configuration Plan 4 (E. 55th St.)	Prt Authority Configuration Plan 4a (E. 55th St.)	Present Worth Factor	Plan 1 (No Action)	Plan 2 (Site 2)	Plan 2a (Site 2a)	Plan 3 (Site 3)	Plan 3a (Site 3a)	Federal Standard Corps Configuration Plan 4 (E. 55th St.)	Prt Authority Configuration Plan 4a (E. 55th St.)
1	2009	$0	$4,350,900	$4,350,900	$4,350,900	$4,350,900	$4,373,400	$4,373,400	0.955795	$0	$4,158,600	$4,158,600	$4,158,600	$4,158,600	$4,180,100	$4,180,100
2	2010	$0	$13,082,050	$7,343,000	$11,203,100	$8,192,400	$6,939,650	$7,804,400	0.913543	$0	$11,951,000	$6,708,100	$10,234,500	$7,484,100	$6,339,700	$7,129,700
3	2011	$0	$15,296,250	$9,557,200	$13,417,300	$10,406,600	$9,131,350	$9,996,100	0.87316	$0	$13,356,100	$8,345,000	$11,715,400	$9,086,600	$7,973,100	$8,728,200
4	2012	$0	$84,224,800	$41,713,100	$70,305,800	$48,005,100	$38,558,800	$44,964,400	0.834561	$0	$70,290,700	$34,812,100	$58,674,500	$40,063,200	$32,179,700	$37,525,500
5	2013	$0	$86,668,600	$44,156,900	$72,749,600	$50,448,900	$41,002,600	$47,408,200	0.797669	$0	$69,132,800	$35,222,600	$58,030,100	$40,241,500	$32,706,500	$37,816,000
6	2014	$0	$85,605,800	$42,844,200	$71,686,800	$49,136,200	$39,606,500	$46,012,300	0.762408	$0	$65,266,500	$32,664,700	$54,654,600	$37,461,800	$30,196,300	$35,080,100
7	2015	$0	$2,917,200	$2,499,100	$2,917,200	$11,608,700	$2,777,800	$2,777,800	0.728705	$0	$2,125,800	$1,821,100	$2,125,800	$8,459,300	$2,024,200	$2,024,200
8	2016	$0	$2,807,200	$2,389,100	$2,807,200	$11,498,700	$2,667,800	$2,667,800	0.696492	$0	$1,955,200	$1,664,000	$1,955,200	$8,008,800	$1,858,100	$1,858,100
9	2017	$0	$2,817,200	$2,399,100	$2,817,200	$69,622,200	$5,112,000	$5,400,900	0.665703	$0	$1,875,400	$1,597,100	$1,875,400	$46,347,700	$3,403,100	$3,595,400
10	2018	$0	$2,807,200	$8,950,100	$2,807,200	$69,612,200	$5,102,000	$5,390,900	0.636276	$0	$1,786,200	$5,694,700	$1,786,200	$44,292,500	$3,246,300	$3,430,100
11	2019	$0	$2,852,200	$8,995,100	$2,852,200	$69,907,300	$20,743,100	$22,883,800	0.608149	$0	$1,734,600	$5,470,400	$1,734,600	$42,514,000	$12,614,900	$13,916,800
12	2020	$0	$2,907,200	$51,088,800	$2,907,200	$2,528,900	$20,798,100	$22,938,800	0.581265	$0	$1,689,900	$29,696,100	$1,689,900	$1,470,000	$12,089,200	$13,333,500
13	2021	$0	$2,365,100	$50,625,800	$2,365,100	$2,058,400	$20,449,200	$22,589,800	0.55557	$0	$1,314,000	$28,126,200	$1,314,000	$1,143,600	$11,361,000	$12,550,200
14	2022	$0	$2,355,100	$50,865,700	$2,355,100	$2,048,400	$5,512,300	$6,116,100	0.531011	$0	$1,250,600	$27,010,200	$1,250,600	$1,087,700	$2,927,100	$3,247,700
15	2023	$0	$2,365,100	$2,026,100	$2,365,100	$2,058,400	$5,522,300	$6,126,100	0.507537	$0	$1,200,400	$1,028,300	$1,200,400	$1,044,700	$2,802,800	$3,109,200
16	2024	$0	$2,390,100	$2,051,100	$2,390,100	$2,083,400	$26,707,500	$31,180,500	0.485101	$0	$1,159,400	$995,000	$1,159,400	$1,010,700	$12,955,800	$15,125,700
17	2025	$0	$2,465,100	$2,126,100	$2,465,100	$2,158,400	$26,782,500	$31,255,500	0.463657	$0	$1,143,000	$985,800	$1,143,000	$1,000,800	$12,417,900	$14,491,800
18	2026	$0	$2,355,100	$2,355,100	$2,355,100	$2,355,100	$26,839,000	$31,312,000	0.443161	$0	$1,043,700	$1,043,700	$1,043,700	$1,043,700	$11,894,000	$13,876,300
19	2027	$0	$2,365,100	$2,365,100	$2,365,100	$2,365,100	$2,219,800	$2,219,800	0.423571	$0	$1,001,800	$1,001,800	$1,001,800	$1,001,800	$940,200	$940,200
20	2028	$0	$2,355,100	$2,355,100	$2,355,100	$2,355,100	$2,209,800	$2,209,800	0.404847	$0	$953,500	$953,500	$953,500	$953,500	$894,600	$894,600
21	2029	$0	$2,400,100	$2,400,100	$2,400,100	$2,400,100	$2,254,800	$2,254,800	0.38695	$0	$928,700	$928,700	$928,700	$928,700	$872,500	$872,500
22	2030	$0	$2,455,100	$2,455,100	$2,455,100	$2,455,100	$2,309,800	$2,309,800	0.36984	$0	$908,000	$908,000	$908,000	$908,000	$854,300	$854,300
23	2031	$0	$2,365,100	$2,365,100	$2,365,100	$2,365,100	$2,219,800	$2,219,800	0.35350	$0	$836,100	$836,100	$836,100	$836,100	$784,700	$784,700
24	2032	$0	$2,355,100	$2,355,100	$2,355,100	$2,355,100	$2,209,800	$2,209,800	0.33787	$0	$795,700	$795,700	$795,700	$795,700	$746,600	$746,600
25	2033	$0	$2,365,100	$2,365,100	$2,365,100	$2,365,100	$2,219,800	$2,219,800	0.32293	$0	$763,800	$763,800	$763,800	$763,800	$716,800	$716,800
26	2034	$0	$2,390,100	$2,390,100	$2,390,100	$2,390,100	$2,244,800	$2,244,800	0.30866	$0	$737,700	$737,700	$737,700	$737,700	$692,900	$692,900
		----------------	----------------	----------------	----------------	----------------	----------------	----------------		----------------	----------------	----------------	----------------	----------------	----------------	----------------
		$ -	$ 339,683,000	$ 355,387,300	$ 294,168,100	$ 437,131,000	$ 326,514,300	$ 369,087,200		$ -	$ 259,359,200	$ 233,969,000	$ 222,671,200	$ 302,844,600	$ 209,672,400	$ 237,521,200

Table 10 - Plan Average Annual Costs- 26 Year Project Evaluation Period



Average Annual Costs By Plan-26 Year Project Evaluation Period- 4 5/8%							
						Base Plan Federal Standard	
	Plan 1	**Plan 2**	**Plan 2a**	**Plan 3**	**Plan 3a**	**Plan 4**	**Plan 4a**
						Corps	**Locals**
						Configuration	**Configuration**
	No	**CDF 2 &**	**CDF 2A &**	**CDF 3 &**	**CDF 3A &**	**E 55th St &**	**E 55th St &**
	Action	**FMP**	**FMP**	**FMP**	**FMP**	**FMP**	**FMP**
Total Implementation Costs							
Contractors Earning Plus Contingencies	$ -	$ 247,448,000	$ 265,712,000	$ 205,691,000	$ 340,339,000	$ 237,929,000	$ 276,987,000
Planning Engineering & Design (PED) Costs	$ -	$ 7,423,400	$ 7,971,400	$ 6,170,700	$ 10,210,200	$ 7,137,900	$ 8,309,600
Construction Management Costs	$ -	$ 14,846,900	$ 15,942,700	$ 12,341,500	$ 20,420,300	$ 14,275,700	$ 16,619,200
Fill Management Costs-Dike 12, 9 - 2009-2014	$ -	$ 7,227,000	$ 7,227,000	$ 7,227,000	$ 7,227,000	$ 7,227,000	$ 7,227,000
Lands, Easements, Rights Of Way, Relocations & Dispos	$ -	$ -	$ -	$ -	$ -	$ 45,000	$ 45,000
Sediment Transportation Costs	$ -	$ 59,419,700	$ 55,216,100	$ 59,419,700	$ 55,616,400	$ 56,581,400	$ 56,581,400
Fish & Wildlife Mitigation	$ -	$ 500,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000
All Other Project Costs	$ -	$ 2,818,000	$ 2,818,100	$ 2,818,200	$ 2,818,100	$ 2,818,300	$ 2,818,000
	--------------------	--------------------	--------------------	--------------------	--------------------	--------------------	--------------------
Total Implementation Costs	$ -	$ 339,683,000	$ 355,387,300	$ 294,168,100	$ 437,131,000	$ 326,514,300	$ 369,087,200
Current Value Of Implementation Costs	$ -	$ 339,683,000	$ 355,387,300	$ 294,168,100	$ 437,131,000	$ 326,514,300	$ 369,087,200
Plan Average Annual Costs	Plan 1	Plan 2	Plan 2a	Plan 3	Plan 3a	Plan 4	Plan 4a
						Corps	Locals
						Configuration	Configuration
	No	CDF 2 &	CDF 2A &	CDF 3 &	CDF 3A &	E 55th St &	E 55th St &
	Action	FMP	FMP	FMP	FMP	FMP	FMP
Investment Costs							
First Costs-Present Value	$ -	$ 259,359,200	$ 233,969,000	$ 222,671,200	$ 302,844,600	$ 209,672,400	$ 237,521,200
Interest During Construction (1)							
	--------------------	--------------------	--------------------	--------------------	--------------------	--------------------	--------------------
Investment Costs	$ -	$ 259,359,200	$ 233,969,000	$ 222,671,200	$ 302,844,600	$ 209,672,400	$ 237,521,200
Average Annual Costs							
Investment Costs	$ -	$ 259,359,200	$ 233,969,000	$ 222,671,200	$ 302,844,600	$ 209,672,400	$ 237,521,200
Partial Payment Factor (2)	0.06690	0.06690	0.06690	0.06690	0.06690	0.06690	0.06690
Average Annual Costs	$ -	$ 17,350,800	$ 15,652,300	$ 14,896,500	$ 20,260,000	$ 14,026,900	$ 15,889,900
Annual Maintenance (3)	-	1,237,200	1,328,600	1,028,500	1,701,700	1,189,600	1,384,900
	--------------------	--------------------	--------------------	--------------------	--------------------	--------------------	--------------------
Total Average Annual Costs	$ -	$ 18,588,000	$ 16,980,900	$ 15,925,000	$ 21,961,700	$ 15,216,500	$ 17,274,800
(1) There is no Interest During Construction since benefits accrue immediately							
(2) Partial Payment Factor based on 26 year project life and a 4 5/8% annual interest rate							
(3) Annual Maintenance taken as 0.5% of Contractors Earnings & Contingencies							

Table 11- Benefit to Cost Ratios by Plan



Benefit To Cost Ratios- 26 Year Project Evaluation Period- 4 58% Annual Interest Rate						NED Plan	
A. Benefits Costs- Shoaling Rates- Outer Harbor=.2 Ft/Yr, Cuy/Old River=1.0 Ft/Yr						Base Plan	
						Federal Standard	
	Plan 1	Plan 2	Plan 2a	Plan 3	Plan 3a	Plan 4	Plan 4a
						Corps	Locals
						Configuration	Configuration
	No	CDF 2 &	CDF 2A &	CDF 3 &	CDF 3A &	E 55th St &	E 55th St &
	Action	FMP	FMP	FMP	FMP	FMP	FMP
Benefits							
Without Project Transportation Costs	$ 100,146,700	$ 100,146,700	$ 100,146,700	$ 100,146,700	$ 100,146,700	$ 100,146,700	$ 100,146,700
With Project Transportation costs	$ 100,146,700	$ 75,222,000	$ 75,222,000	$ 75,222,000	$ 75,222,000	$ 75,222,000	$ 75,222,000
	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------
Plan Benefits	$ -	$ 24,924,700	$ 24,924,700	$ 24,924,700	$ 24,924,700	$ 24,924,700	$ 24,924,700
Costs							
With Project Harbor Maintenance Costs	$ -	$ 18,588,000	$ 16,980,900	$ 15,925,000	$ 21,961,700	$ 15,216,500	$ 17,274,800
Without Project Habor Maintenance Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------
Plan Costs	$ -	$ 18,588,000	$ 16,980,900	$ 15,925,000	$ 21,961,700	$ 15,216,500	$ 17,274,800
Plan Benefit Cost Ratios							
Plan Benefits	$ -	$ 24,924,700	$ 24,924,700	$ 24,924,700	$ 24,924,700	$ 24,924,700	$ 24,924,700
Plan Costs	$ -	$ 18,588,000	$ 16,980,900	$ 15,925,000	$ 21,961,700	$ 15,216,500	$ 17,274,800
Plan Benefit To Cost Ratio	0.00	1.34	1.47	1.57	1.13	1.64	1.44
Plan Net Benefits	$ -	$ 6,336,700	$ 7,943,800	$ 8,999,700	$ 2,963,000	$ 9,708,200	$ 7,649,900
--							
						NED Plan	
B. Benefits Costs- Shoaling Rates- Outer Harbor=.2 Ft/Yr, Cuy/Old River=2.0 Ft/Yr						Base Plan	
						Federal Standard	
	Plan 1	Plan 2	Plan 2a	Plan 3	Plan 3a	Plan 4	Plan 4a
						Corps	Locals
						Configuration	Configuration
	No	CDF 2 &	CDF 2A &	CDF 3 &	CDF 3A &	E 55th St &	E 55th St &
	Action	FMP	FMP	FMP	FMP	FMP	FMP
Benefits							
Without Project Transportation Costs	$ 103,292,900	$ 103,292,900	$ 103,292,900	$ 103,292,900	$ 103,292,900	$ 103,292,900	$ 103,292,900
With Project Transportation costs	$ 103,292,900	$ 75,222,000	$ 75,222,000	$ 75,222,000	$ 75,222,000	$ 75,222,000	$ 75,222,000
	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------
Plan Benefits	$ -	$ 28,070,900	$ 28,070,900	$ 28,070,900	$ 28,070,900	$ 28,070,900	$ 28,070,900
Costs							
With Project Harbor Maintenance Costs	$ -	$ 18,588,000	$ 16,980,900	$ 15,925,000	$ 21,961,700	$ 15,216,500	$ 17,274,800
Without Project Habor maintenance Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------	------------------------
Plan Costs	$ -	$ 18,588,000	$ 16,980,900	$ 15,925,000	$ 21,961,700	$ 15,216,500.00	$ 17,274,800.00
Plan Benefit Cost Ratios							
Plan Benefits	$ -	$ 28,070,900	$ 28,070,900	$ 28,070,900	$ 28,070,900	$ 28,070,900	$ 28,070,900
Plan Costs	$ -	$ 18,588,000	$ 16,980,900	$ 15,925,000	$ 21,961,700	$ 15,216,500	$ 17,274,800
Plan Benefit To Cost Ratio	0.00	1.51	1.65	1.76	1.28	1.84	1.62
Plan Net Benefits	$ -	$ 9,482,900	$ 11,090,000	$ 12,145,900	$ 6,109,200	$ 12,854,400	$ 10,796,100

APPENDIX H

ISSUE RESOLUTION CONFERENCE MEETING MINUTES

Cleveland Harbor
Dredged Material Management Plan
Issue Resolution Conference
14 June 2006
1:00 – 5:00

Meeting Minutes

Meeting Attendees:

NAME		AGENCY	PHONE	E-MAIL
Alsenas,	Paul	Cuyahoga County Planning Commission	216-443-3700	palsenas@cuyahogacounty.us
Alvarado	Christopher	Cuyahoga County Planning Commission	216-443-3700	calvarado@cuyahogacounty.us
Asquith	Michael	USACE, Buffalo District	716-879-4352	Michael.asquith@usace.army.mil
Bankey	Mindy	Ohio Department of Natural Resources	614-265-6836	Mindy.bankey@dnr.state.oh.us
Berkeley	Phil	USACE, Buffalo District	716-879-4145	Philip.e.berkeley@usace.army.mil
Berry,	Debbie	City of Cleveland	216-664-6740	dberry@city.cleveland.oh.us
Bournique	Randy	Ohio Environmental Protection Agency	614-644-2013	Randy.bournique@epa.state.oh.us
Brown	Jonathan	USACE, Buffalo District	716-879-4430	Jonathan.w.brown@usace.army.mil
Brown	Robert	Cleveland City Planning	216-664-3467	rnbrown@city.cleveland.oh.us
Brown	Tab	USACE, Lakes and Rivers Division	513-684-2974	Theodore.a.brown@usace.army.mil
Cox,	Jim	Flats Industry Association	216-241-8060	jimcoxiii@scbglobal.net
Edger	Elva	League of Women Voters	440-826-0157	
Greer,	Lynn	USACE, Buffalo District	716-879-4260	lynn.m.greer@usace.army.mil
Haberly	Roger	USACE, Buffalo District	716-879-4164	Roger.e.haberly@usace.army.mil
Hambly	Charles	Cuyahoga River RAP	216-241-2414 x253	Hamblyc@cuyahogariverrap.org
Harkins	Rick	Lake Carriers Association	216-861-0591	harkins@lcaships.com
Hauser	Ed	Interested Citizen	216-651-3476	ejhauser@ameritech.net
Hedrick	Ray	USACE, Nashville District	615-736-5026	Ray.d.hedrick@usace.army.mil
Hempfling	Tom	USACE, Lakes and Rivers Division	312-353-6351	Thomas.hempfling@usace.army.mil
Hicks	Craig	USDA, Wildlife Services	216-664-6897	craig.r.hicks@usda.aphis.gov
Holland,	Steve	Ohio, Department of Natural Resources, Office of Coastal Management	419-626-7980	steven.holland@dnr.state.oh.us
LaWell	Michael	Mittal Steel USA	216-401-9132	mwlawell@aol.com
Martin	Barbara	League of Women Voters	440-243-9070	barbaramartin2001@juno.com
McKenna	Patti	USACE, Buffalo District	716-879-4367	patrice.m.mckenna@usace.army.mil
Pfeiffer,	Stephen	Port of Cleveland	216-241-8004	spfeiffer@portofcleveland.com
Regener	Carla	Cuyahoga County Planning Commission	216-443-3700	cregener@cuyahogacounty.us
Ryan,	Dana	Cleveland Airport Systems	216-898-5215	dryan@clevelandairport.com
Stumpe,	Lester	Northeast Ohio Regional Sewer District	216-881-6600	stumpel@neorsd.org
Worthington	Rich	USACE, Headquarters	202-761-4523	richard.t.worthington@usace.army.mil
Zavoda	Rich	Mittal Steel USA	216-429-6542	rzavoda@mittalsteel.com
Zimmerman	Angela	U.S. Fish and Wildlife Service	614-469-6923 x22	angela_zimmerman@fws.gov

Agenda:

1:00 – 1:30	Introductions
1:30 – 3:00	Interactive Discussion of Cleveland DMMP
3:00 – 3:15	Break
3:15 – 4:00	Questions and Wrap Up

General Summary

Phil Berkeley, Plan Formulator of the Cleveland Harbor Dredged Material Management Plan (DMMP) provided a power point presentation to discuss the status of the Cleveland Harbor DMMP. During the course of the presentation meeting attendees participated in discussions, and questions and answer sessions. A copy of the Power Point presentation will be temporarily available at the project website listed below.

Project Website

The Cleveland Harbor DMMP project has a website where you can obtain copies of final documents. The address is:
http://www.lrb.usace.army.mil/missions/cleveland/index.html#DMMP

Public Information Meeting

USACE will notify all meeting attendees and those on the e-mail distribution list of the date, time, and location of the Public Information Meeting, tentatively scheduled for later this summer.

Measures

USACE returned to Buffalo with additional measures to consider and address in the DMMP Environmental Impact Statement (EIS) including use of adjacent harbor CDFs, develop a regional CDF, and implement sediment traps and address sediment loading.

Best Management Practices

There was a high degree of stakeholder interest in measures to control/reduce sedimentation in the Cuyahoga River. USACE recognizes that we would most likely need additional authority to participate in implementing such measures. The DMMP EIS will however document work to date on sediment management and identify ongoing efforts.

Sediment Transport Model

There was significant discussion pertaining to the Sediment Transport Model currently being developed by USACE, Buffalo District. Project status and Project Manager contact information is below:

The ultimate goal of the Great Lakes Tributary Modeling program is to provide local interest with tools that will support state and local prioritization and implementation of best management practices designed to keep non-point source pollution (sediment) on the land. These tools can help local interests better manage sedimentation issues and, if they implement appropriate practices, should reduce the loading of sediments and pollutants to navigation channels and Area of Concerns. This will reduce costs for navigation maintenance and promote the restoration of beneficial uses over time. The model that is being created for the Cuyahoga River is the Soil and Water Assessment Tool (SWAT) model designed to understand watershed-scale sediment contributions and water quality issues. The SWAT model is interfaced with the Better Assessment Science Integrating point and Non-point Sources (BASINS) Geographic Information System (GIS). The model will provide stakeholders with the ability to look critically at land uses in the basins and estimate the effects of best management practices related to land use. A meeting to discuss the model capabilities and to transfer the technology to local interests is being scheduled for September 2006.

Project Manager: Tony Friona
Phone: 716-879-4215
Fax: 716-879-4194
E-mail: Anthony.m.friona@usace.army.mil

Habitat Creation

Habitat creation was mentioned both in the context of beneficial use and CDF design. The IRC documentation clearly indicates that beneficial use will be addressed but does not currently mention the potential of creative CDF design to create presumably aquatic habitat. The next iteration of the document will address habitat creation within CDF designs.

Due to the open communication and forum provided at the Issue Resolution Conference, the meeting minutes document the communications among meeting participants and identify the applicable section of the presentation.

Definition of DMMP

A DMMP is a study conducted to verify that all Federally maintained Navigation projects have sufficient capacity for dredged material disposal for a minimum of 20 years. Requirements for the study are listed below:

1. Establish a Base Plan for the Project.
2. Assess the potential for beneficial use of dredged material.
3. Establish a Management Plan for the Project
4. Demonstrate that continued maintenance is economically warranted based on high-priority (non-recreational benefits).

Lester Stumpe (NE Ohio Regional Sewer District): Can the project (DMMP) include sediment traps and erosion control measures?

Rich Worthington (HQ USACE): USACE does not currently have the authority to conduct such studies; sediment traps and like projects would require congressional authorization.

Phil Berkeley (USACE, Buffalo District): USACE is considering many alternatives which will be discussed later in the presentation.

Problems and Opportunities

- CDF Site 10B will be essentially filled in 2006.
- No further CDF capacity available without modifications.
- Historical average annual dredging and disposal of 330,000 cy.
- Fill Management Plans being developed for 2007-2011 disposal.
- Fill Management Plans needed for 2012 and 2013.
- Beyond 2013 will need a new CDF or disposal method for dredged material at Cleveland.

Paul Alsenas (Cuyahoga County Panning Commission):

Q1. Is sediment traps part of the Fill Management Plan (FMP)?

A1. Phil Berkeley (USACE, Buffalo District): No, however USACE will consider potential impacts of sediment trap use.

Q2. Is dewatering of dredged material being considered under the FMP?

A2. Mike Asquith (USACE, Buffalo District): No. Dredging in Cleveland Harbor occurs two times per year allowing no time for consolidation.

Q3. Has USACE considered other dredging mechanisms to minimize the quantity of water discharged?

A3. Mike Asquith (USACE, Buffalo District): Yes but USACE is limited, through contractual procedures, to the Contractor's who bid on the job and the equipment they have available.

Barbara Martin (League of Women Voters):

Q1: How often does USACE dredge the Outer Harbor?

A1. Mike Asquith (USACE, Buffalo District): USACE dredges the Outer Harbor every 3-5 years.

Steve Pfeiffer (Port Authority): The Port Authority dredges approximately 10,000 cubic yards every 7 years. Overall, the eastern portion of the Outer Harbor is not maintained to authorized depths.

Q2. Where do freighters enter the harbor?

A1. Steve Pfeiffer (Port Authority): Freighters use the Entrance Channel to gain access to the Harbor and River Channels.

Existing Conditions – Port of Cleveland

Bob Brown (Cleveland City Planning): Suggested when assessing the economic importance of the City and Port of Cleveland, studies should include Akron, Lorain, and Cleveland.

Ed Hauser (Interested Citizen): Requested clarification of the difference between the Port of Cleveland and the Port Authority, and Harbor and River Channel authorized depths.

Steve Pfeiffer (Port Authority): The 'Port' includes the entire Cleveland area. The Port Authority is a separate entity that has no control over other industry and private lands within the Port. The Port Authority receives approximately 35% of harbor tonnages; approximately 65% of harbor tonnages are delivered throughout the Port, mainly to industry located upstream in the Cuyahoga River.

Lynn Greer (USACE, Buffalo District): Informed meeting attendees page 6 of the IRC documentation provides channel depth details.

Barbara Martin (League of Women Voters): Does USACE require non-Federal users of the CDF to sample sediment that will be disposed in the Federal facility?

Lynn Greer (USACE, Buffalo District): USACE conducts sediment sampling in Cleveland Harbor and Cuyahoga River Channels every five years. When a non-Federal user requests use of the Federal facility to dispose dredged sediment USACE must assess the suitability of the material for placement in the CDF. However, if the non-Federal user proposes to dredge an area in close proximity to a sediment sampling site located within the Federal Channel, USACE will use the results from the Federal sampling location to determine the suitability of the material. If a Federal sampling site does not exist in close proximity to proposed non-Federal dredged area, USACE would require the non-Federal users to conduct sampling. Sediment sampling results are then forwarded to USACE and [I] would analyze them to determine suitability for placement in the CDF.

Burke Lakefront Airport (BKL)

Phil Berkeley included BKL statistics and noted there are impacts the current operational CDF10B has on BKL operations.

Bob Brown (Cleveland City Planning): Are there new FAA regulations to prevent CDF construction?

Dana Ryan (Port Control): CDFs are deemed non compatible use with airports due to wildlife attractants caused by their operations. FAA has concerns with any construction, specifically CDF construction, within a 4-5 mile radius of the airport.

Base Case Dredging (and Map identifying existing and proposed CDFs)

Phil Berkeley explained the Base Case identifies current and potential future dredging conditions that are used to provide a comparison to the selected alternative plan under the DMMP. The comparison is used to determine the feasibility of the selected alternative plan. The Base Case assumes that all dredged material will be placed in existing or yet to be constructed CDFs. The Base Case begins in 2007, when CDF capacity has been exhausted without implementation of FMPs at existing CDFs.

Debbie Berry (Cleveland City Planning): What are the impacts of reduced dredging?

Michael LaWell (Mittal Steel): Reduced dredging requires an increase in private dredging between the Federal Channel and private dock.

Rick Harkins (Lake Carriers Association): The reduction in dredging means the channel width may not be as wide as in the past.

Steve Pfeiffer (Port Authority): Every year it is necessary to assess where dredging is needed most. Upstream near Mittal Steel is a crucial area that requires frequent dredging.

Phil Berkeley (USACE, Buffalo District): Phil reiterated the Base Case is an assumption and may not reflect actual occurrences.

Rick Harkins (Lake Carriers Association): [I] Participate in annual soundings of the Federal Channels with USACE and Masters to assess areas that need to be dredged annually.

Mike Asquith (USACE, Buffalo District): Part of the problem is a decreasing Federal budget that prevents USACE from dredging additional quantities from the harbor. Aside from the current capacity issue at the harbor, funds are not currently available to dredge more than 300,000 cubic yards per year.

Barbara Martin (League of Women Voters): Confirmed that reduced Federal funds is Great Lakes wide, not unique to Cleveland Harbor.

Paul Alsenas (Cuyahoga County Planning Commission): Are other harbors being assessed (such as Ashtabula) etc. to provide a facility (CDF) to be used by multiple harbors?

Rick Harkins (Lake Carriers Association): Stated a regional facility would be cost prohibitive.

Michael LaWell (Mittal Steel): Stated upland disposal has also been done in the past but cost prohibitive.

Paul Alsenas (Cuyahoga County Planning Commission): Is rail transport being considered?

Phil Berkeley (USACE, Buffalo District): Yes.

Paul Alsenas (Cuyahoga County Planning Commission): Clarify that it is not just cost of alternatives being considered but FAA requirements, Lakefront development, etc. Paul requested clarification of who pays for Federal dredging.

Mike Asquith (USACE, Buffalo District): USACE is responsible to dredge Cleveland Harbor and Cuyahoga River Channels two times per year. The cost includes plans and specifications, bids, contracts, and actual dredging and disposal.

Michael LaWell (Mittal Steel): Added that non-Federal entities often 'piggy back' the Federal contract and obtain the same contractor to dredge the non-Federal docks.

Paul Alsenas (Cuyahoga County Planning Commission): Confirmed USACE operates and maintains the CDF (10B).

Phil Berkeley (USACE, Buffalo District): Reiterated the Base Case proposed building a CDF somewhere in the Outer Harbor. Outer Harbor CDFs are much deeper and provide greater capacity; this would allow for 'catch up' dredging from 2014 – 2020 as assumed in the Base Case.

Steve Pfeiffer (Port Authority): Took the opportunity to remind meeting attendees that CDFs provide opportunity for future development. When facility 14 was proposed many people opposed its' construction, now it is coveted lakefront property that many are trying to protect for wildlife habitat and educational outreach.

Michael LaWell (Mittal Steel): We need to remember the end use and value to the region for creating a CDF is lakefront property.

Ed Hauser (Interested Citizen): Paul mentioned earlier the possibility of rail transport. What technology is available for dewatering dredged sediment to allow for rail transport?

Lynn Greer (USACE, Buffalo District): There are various means that enable dewatering and some will be mentioned when we discuss Beneficial Use of dredge material.

Bob Brown (Cleveland City Planning): Reiterated that local preferences should be considered due to cost share requirements. CDF 10B has marginal use for lakefront development.

Steve Pfeiffer (Port Authority): Stated that CDF 10B was expected to be used for BKL expansion.

Bob Brown (Cleveland City Planning): Stated there is little need for BKL expansion at this point in time.

Lynn Greer (USACE, Buffalo District): Informed attendees that during Phase I of the DMMP, USACE met on many occasions with Federal, State, and local interests to identify alternative locations for proposed future CDFs. The purpose of the coordination was to identify future development plans when identifying proposed CDFs for consideration. The proposed sites on the map (2.3 in IRC documentation) took into consideration the City of Cleveland's 50 Year Waterfront Development Plan.

Ed Hauser (Interested Citizen): What is the depth of water at the outer harbor sites? Are CDFs lined?

Mike Asquith (USACE, buffalo District): The depth at the proposed CDF locations varies. CDFs are not lined.

Lynn Greer (USACE, Buffalo District): Informed attendees that page 31a of the IRC documentation provides the depth of water at each proposed CDF location in addition to other statistics.

Ed Hauser (Interested City): Questioned how the facilities contain contaminated material if they are not lined?

Lynn Greer (USACE, Buffalo District): The CDFs are semi porous structures. As the facilities are filled with dredged material, sediment fills the voids within the rock perimeter preventing discharge outside of the facility. In 2004 USACE conducted sediment sampling within and adjacent to currently operational CDFs and found no leaching of material beyond the boundaries of the CDF.

Chuck Hambly (Cuyahoga River RAP Coordinator): RAP has taken cores from within the river that show overall sediment is getting cleaner but there is still contaminated 'legacy' sediments in the river.

Lynn Greer (USACE, Buffalo District): In addition to what Chuck stated about legacy sediments, USACE has historical sediment data. I recently worked on a project with OEPA and ODNR where I compared contaminants of concern from historical sampling events (1993, 1998, and 2002) and found that there is still significant contamination of sediments that warrant placement in a CDF. However, the data shows the hotspots have migrated through the river.

Lester Stumpe (NE Ohio Regional Sewer District): Can we have copies of the data?

Lynn Greer (USACE, Buffalo District): Sediment sampling reports can be obtained through Freedom of Information Act (FOIA) requests. The data analysis has been shared with many entities in this room including OEPA, ODNR, and the Cuyahoga River RAP (Marie Sullivan).

Barbara Martin (League of Women Voters): Fish are now spawning in the Cuyahoga River, how is it possible that material is still contaminated?

Lynn Greer (USACE, Buffalo District): ODNR for the first time in many years has placed an environmental window on Cleveland Harbor. An environmental window is a period of time in which no in water construction activity can occur in order to protect fish spawning. However, the window placed on the Cuyahoga River is for an area upstream of the Federal Channel limits. So, for the purposes of this project and area of interest, there is no environmental window.

Craig Hicks (USDA, Wildlife Services): Can non-Federal entities recoup benefits from a CDF for future development?

Phil Berkeley (USACE, Buffalo District): USACE turns CDFs over to non-Federal sponsors once they have been filled to capacity, at which point the users can develop the property. USACE does not necessarily place limitations on the use but the user must consider structural integrity of the CDF for development.

Rich Worthington (HQUSACE): Non-Federal entities could build a facility on a CDF that has been turned over.

Steve Pfeiffer (Port Authority): To expand on that, a problem with a non-Federal entity building a CDF vs. the Corps constructing the CDF is that there is no guarantee the non-Federal entity would recoup the money. The Port Authority could build a new CDF using revenue bonds but the constrained budget of the Corps may prevent USACE from having money to pay the tipping fee to use the non-Federal facility. In that case the Port could not recoup funds for the revenue bonds. Or, if the Corps could pay the tipping fee it would most likely mean a reduction in the amount of material dredged from the harbor channels.

Tab Brown (USACE, Lakes and Rivers Division): In addition Great Lakes funding has decreased overall.

**skipped slides 28 -32 (without project conditions and Key Assumptions)*

Economic Justification

- $ 293,000,000 Federal Investment at Cleveland Harbor since late 1800's.
- Based on 2003 tonnage data continued maintenance dredging is economically justified.
- Based on preliminary analysis over $200,000,000 in new work at Cleveland is justified.

Rich Worthington (HQ USACE): The economics justify expending a total of $200 million to construct a new CDF. The $200 million is comprised of Federal and non-Federal cost share requirements.

Jon Brown (USACE, Buffalo District): The $200 million value is based on the National Economic Development (NED) losses prevented by continued maintenance of the harbor (dredging). The NED includes transportation commodity.

Debbie Berry (Cleveland City Planning Commission): How close are we from being able to open lake place sediment dredged from Cleveland Harbor and Cuyahoga River Channels?

Lynn Greer (USACE, Buffalo District): OEPA has recently tried to minimize open lake placement in the Western Basin of Lake Erie; I would defer to OEPA to address the likelihood of this occurring in the Central Basin, which could affect Cleveland Harbor.

Randy Bournique (OEPA): It is true that OEPA has tried to minimize open lake placement and we are encouraging beneficial use of dredged sediment over open lake placement.

Debbie Berry (Cleveland City Planning): Does the Base Case assumption include cost share requirements?

**Skip to slide 49 of 70 – Cost Sharing)*

Cost Sharing

Rich Worthington (HQ USACE): Cost share requirements for construction of a new CDF is 75% Federal 25% non-Federal due at time of construction. Another 10% non-Federal is due over 30 years and any costs associated with Lands, Easements, Rights-of-Way, Relocations and Disposal Areas (LERRD's).

Roger Haberly (USACE, Buffalo District): When developing CDF costs, all costs associated with making that CDF usable is included in the costs. Thus if there are utility relocations (gas water, electric, cable), sewer line or outfall extensions, the costs associated with these components are added into the total cost of the CDF. Thus when comparing one CDF cost to another, these costs include all costs (Federal and non-Federal) that are needed to make the CDF operational.

Phil Berkeley (USACE, Buffalo District): Reiterated that the selected alternative must be engineeringly feasible, economically justified, and environmentally acceptable.

Ed Hauser (Interested Citizen): Will the EIS identify official end state land use?

Phil Berkeley/Patti McKenna (USACE, Buffalo District): The DMMP EIS will provide recommendations for end use but USACE does not dictate end use requirements once a facility is turned over to the local sponsor.

Ed Hauser (Interested Citizen): The County is completing a Maritime Study; will this study be included in the EIS?

Phil Berkeley: The DMMP EIS schedule proposes distributing the Draft DMMP EIS for public comment and review in June 2007 and completing the Final DMMP EIS in 2008. If the Maritime Study is complete before the dates in the USACE schedule it will be considered, in some degree, in the DMMP EIS documentation.

**Returned to slides 35 through 43 title ‘Measures’*

Measures (Treatment)

Craig Hicks (USDA, Wildlife Services): Has USACE sampled sediments within the CDF to identify is treatment is needed?

Lynn Greer (USACE, Buffalo District): USACE sampled sediments within currently operational CDFs in 2004. The results from facility 10B were not what was expected; specifically coarse grain material that USACE has been disposing in the west end of CDF 10B for potential harvesting and beneficial use was more contaminated that what would be expected of material of the grain size and physical characteristic.

Debbie Berry (Cleveland City Planning): To add to that the City is working with USEPA, Cuyahoga Brownfields, Cuyahoga County Soil and Water District to complete a Risk Assessment at CDF 14.

Ed Hauser (Interested Citizen): [to Debbie Berry] Has the new Mayor [Jackson] approved the City’s 50 Year Waterfront Development Plan? And what is the Mayor’s focus? Is the Mayor supportive of relocating the Port Authority to the outer harbor land mass, proposed CDF number 2?

Debbie Berry (Cleveland City Planning): The status of the City’s 50 Year Waterfront Development Plan is beyond the scope of this meeting however the Mayor would like to see stronger connections to the east. The Mayor is supportive of relocating the Port Authority.

Measures (Beneficial Use)

Lester Stumpe (NE Ohio Regional Sewer District): What qualifies as beneficial use?

Phil Berkeley (USACE, Buffalo District): Wetland development under Section 204 would be considered beneficial use.

Lynn Greer (USACE, Buffalo District): Beneficial use can also include dredge soil, mixture of sediment with other aggregates to create sub grade for road construction, or daily landfill cover. However, there needs to be a market for such uses.

Mike Asquith (USACE, Buffalo District): Reuse of sediment has occurred on a pilot project basis at Toledo Harbor. Approximately 10,000 cubic yards are reprocessed annually. Here at Cleveland, you would need 330,200 cubic yards processed per year. In addition you would need to identify potential users, needs, quantity needed for each project or annual quantities, etc.

Tab Brown (USACE, Lakes and Rivers Division): Alternative measures must be compared to the Base Plan; the Base Plan is assumed the least costly. If any alternative measure is above the cost of the Base Plan, it would require cost sharing.

Elva Edger (League of Women Voters): Who owns CDF 14?

Steve Pfeiffer (Port Authority): The Port Authority owns CDF 14 until the City requests ownership.

Final Questions/Wrap Up

Michael LaWell (Mittal Steel): What is the next step?

Phil Berkeley (USACE, Buffalo District): Phil referenced the current schedule:

- June 2006 – Issue Resolution Conference.
- Summer 2006 – EIS Public Scoping Meeting.
- September 2006 – Draft DMMP/DEIS completed.
- December 2006? – Alternative Formulation Briefing.
- January 2007 – Independent Technical Review of DMMP/DEIS.
- June 2007 – Agency and Public Review of DMMP/DEIS.
- September 2007 – Final DMMP/DEIS completed.
- November 2007 - Independent Technical Review of DMMP/FEIS
- January 2008 – Agency and Public Review of DMMP/FEIS.
- TBD - Record of Decision Signed.

Lester Stumpe (NE Ohio Regional Sewer District): What is the schedule for construction of a new CDF?

Mike Asquith (USACE, Buffalo District): USACE has allocated two years for Plans and Specifications and three years for construction.

Tab Brown (USACE, Lakes and Rivers Division): Construction of a new CDF pends funding.

Phil Berkeley (USACE, Buffalo District): Funding is an important point; we cannot proceed with construction unless Congress and the President pass the budget. We are not asking you to lobby but it is important that you understand we can only request the funds.

Lynn Greer (USACE, Buffalo District): It is also important to note the USACE budget process. USACE requests its budget two years in advance. If we are proposing to have a facility operational in 2014 we are scheduling construction in 2011 through 2013 which means we will be requesting construction funds in 2009 through 2011. Since we complete our budget two years in advance we will be completing the 2009 budget one year from now.

Lester Stumpe (NE Ohio Regional Sewer District): It is important to discuss beneficial use specifically habitat development outside the breakwall for any alternative.

Paul Alsenas (Cuyahoga County Planning Commission): How can there be more forums/interaction regarding the status of the project?

Rich Worthington (HQ USACE): It is essential to maintain communication and go beyond the guidance and meet frequently through workshops, conferences, etc.

Lynn Greer (USACE, Buffalo District): During Phase I of the DMMP USACE met monthly with Federal, State, local entities, and at times interested citizens for approximately 15 months in an effort to coordinate this project and identify proposed CDFs that meet the needs and interest of the community. At the completion of Phase I USACE informed all parties that correspondence during Phase II would be less frequent, however USACE can look at the schedule and identify when additional meetings can be scheduled to communicate project status and share information.

Barbara Martin (League of Women Voters): Is the County a project sponsor? If no, why not?

Lynn Greer (USACE, Buffalo District): No, the current Project Sponsors are the City of Cleveland and Port Authority. During Phase I meetings, USACE continued to solicit a project sponsor. It was the City and Port Authority who offered to be the Project Sponsor and submitted a Letter of Intent to the Corps of Engineers.

Barbara Martin (League of Women Voters): What is the expected life of current facilities? Can you clarify the two year gap? When will a new alternative disposal area be available?

Mike Asquith (USACE, Buffalo District): Through implementation of the Fill Management Plan, CDF 10B is expected to provide capacity through 2008 and CDF 12 is expected to provide capacity through 2011. Since a new facility is not expected to be operational until 2014, there is a period between 2012 and 2013 in which we have not yet identified where dredged material will be disposed.

Barbara Martin (League of Women Voters): The Environmental Assessment for the Interim Plan at CDF 12 states the plan is expected to provide capacity through 2012.

Lynn Greer (USACE, Buffalo District): USACE originally planned on having a facility operational in 2013, however due to the budget process and the need for a Project Cooperation Agreement to be signed between USACE and the project sponsor before USACE requests funds from the President, we reevaluated the scheduled and pushed the date back one year to 2014 in an effort to ensure all agreements, real estate documents, and approvals are in place. In addition, we are now projecting the Fill Management Plan at CDF 12 to provide capacity through 2011 vs. 2012. This is due to the fact that the EA was written using a conceptual design. USACE is now formally looking at the design to meet FMP needs and capacity issues. However, the modifications to the design, in an effort to maximize capacity at the facility will not require a new EA.

Jon Brown (USACE, Buffalo District): Who, if anyone, is looking at doing anything to address or minimize sediment loads and implement sediment traps?

Paul Alsenas (Cuyahoga County Planning Commission): Sediment loading must be looked at holistically.

Phil Berkeley (USACE, Buffalo District): USACE has budgeted the last two years for funds to conduct a watershed study; Congress will not appropriate funds.

Lynn Greer (USACE, Buffalo District): USACE has spent three years developing a Sediment Transport Model for use in the Cuyahoga Watershed. The model has been developed at 100% Federal costs. Once the model is complete it will be turned over to a local 'keeper'. It is important for the community and agencies to gather and input information and data to make the model as effective as possible.

Michael LaWell (Mittal Steel): Informed attendees that at one point the steel mill was going to close. Now Mittal Steel is the number one steel mill in the world for production/hour. The steel company ranking is something the community and company is proud of; it is important to maintain the harbor so to maintain production at the plant.

Lester Stumpe (NE Ohio Regional Sewer District): The Preliminary Assessment on pages 31 a and b of the IRC documentation does not provide a detailed explanation of the ranking.

Lynn Greer (USACE, Buffalo District): The ranking is subjective to whoever is completing the table; however USACE has completed detailed documentation to justify the various matrix rankings. The matrix justifications will be included in subsequent reports.

Jon Brown (USACE, Buffalo District): Should without project conditions include BKL closure and other land use for current property?

Phil Berkeley (USACE, Buffalo District): USACE cannot solve or dictate how to manage City issues. It is not practicable for USACE to look at alternatives that include facility closures.

Paul Alsenas (Cuyahoga County Planning Commission): Will the comments received today and comments provided in the future be acknowledged in the report?

Phil Berkeley (USACE, Buffalo District): Yes, the report will acknowledge, to an extent comments received.

Barbara Martin (League of Women Voters): How far can material be pumped?

Mike Asquith (USACE, Buffalo District): The distance material can be pumped is variable. While in the lake, under water, material can be pumped up to five miles. Upland pumping distances are dependent upon topography and equipment (pumps). There must be a means to decant the water.

Rick Harkins (Lake Carriers Association): Trucking material to upland sites requires a dewatering facility, and would have negative impacts to the City of Cleveland including a large quantity of trucks hauling foul smelling material through the City which would inevitably cause extensive road damage.

Meeting adjourned at 4:45 pm.

APPENDIX I

FISH AND WILDLIFE COORDINATION ACT REPORT

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
6950 Americana Parkway, Suite H
Reynoldsburg, Ohio 43068-4127
(614) 469-6923/FAX (614) 469-6919

April 10, 2007

Lt. Colonel John S. Hurley
District Engineer
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Attention: Environmental Coordinator, Ms. Patrice McKenna

Dear Colonel Hurley:

The U. S. Fish and Wildlife Service respectfully submits this Draft Fish and Wildlife Coordination Act Report for the Dredged Material Management Plan for Cleveland Harbor, Cuyahoga County, Ohio. This Report has been prepared by the Service, in coordination with the Ohio Department of Natural Resources, Division of Wildlife, and provides information on the fish and wildlife resources in the project vicinity and an assessment of the potential environmental impacts on those resources from implementation of the proposed project. In addition, this Report recommends measures that should be taken to avoid, minimize, and compensate impacts to these important resources.

This Draft Report does **not** constitute Section 7 consultation under the Endangered Species Act of 1973, as amended. The Corps must still submit to the Service a written determination of impacts on the bald eagle and piping plover critical habitat. In 2006, this office provided your staff with information regarding the Federally-listed species for the project vicinity.

This document has been prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), the Endangered Species Act of 1973, as amended, and is consistent with the intent of the National Environmental Policy Act of 1969 and the U. S. Fish and Wildlife Service's Mitigation Policy.

If you have questions, or if we may be of further assistance in this matter, please contact me at extension 12 in this office.

Sincerely,

Mary Knapp

Mary Knapp, Ph.D.
Supervisor

Enclosures

cc: Ohio DNR, Division of Wildlife, SCEA Unit, Columbus, OH
Ohio EPA, 401/Wetland Section, Attn: Randy Bournique, Columbus, OH
USEPA, Office of Environmental Review, Chicago, IL

Ohio Department of Natural Resources

TED STRICKLAND, GOVERNOR
SEAN D. LOGAN, DIRECTOR

Division of Wildlife
Anthony T. Trevena, Acting Chief
2045 Morse Rd., Bldg. G
Columbus, OH 43229-6693
Phone: (614) 265-6300

REC'D APR 09 2007

April 4, 2007

Dr. Mary Knapp, Supervisor
U.S. Fish and Wildlife Service
Ecological Services
6950 Americana Parkway, Suite H
Reynoldsburg, Ohio 43068-4127

RE: Dredged Material Management Plan for Cleveland Harbor
Cuyahoga County

Dear Dr. Knapp:

The Ohio Department of Natural Resources, Division of Wildlife (DOW) has received the draft Fish and Wildlife Coordination Act report your office prepared for the project referenced above. After reviewing the report the DOW submits this letter to state our concurrence with the recommendations described in the report.

If you have any questions, please contact Becky Jenkins at (614)265-6631.

Sincerely,

JOHN NAVARRO
Program Administrator

JN/BJ/al

DRAFT Fish and Wildlife Coordination Act Report
Section 2(b)

Dredged Material Management Plan for Cleveland Harbor, Cleveland, Cuyahoga County, Ohio

Prepared for:
U.S. Army Corps of Engineers
Buffalo District
Buffalo, NY

Prepared by:
Department of the Interior
U.S. Fish and Wildlife Service
Reynoldsburg Ohio Field Office
Reynoldsburg, Ohio

Preparer: Angela L. Zimmerman
Fish and Wildlife Biologist

April 2007

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I. EXECUTIVE SUMMARY

Cleveland Harbor is located on Lake Erie at the mouth of the Cuyahoga River. The harbor is 191 miles southwest of Buffalo, NY and 110 miles east of Toledo, Ohio (Figure 1). Included in the study area are the Outer Harbor and Cuyahoga River Channels. The harbor measures about 1,300 acres, is 5 miles long and varies in width between 1,600 to 2,400 feet (Figure 2).

Since the 1960's, five Confined Disposal Facilities (CDFs) have been constructed at Cleveland Harbor. The current operational CDF 10B is nearing design capacity. As a result, the U.S. Army Corps of Engineers has prepared a Dredged Material Management Plan for Cleveland Harbor. The Preferred Alternative Plan 2a would involve the construction of a two-celled Confined Disposal Facility. Cell 1 to be constructed and available for disposal of dredged material in 2012 and would be approximately 50 acres in size. It would be formed on the north side by incorporation of the existing West Breakwater at Cleveland. To the east and south, Cell 1 would be formed by the construction of new perimeter walls probably of sheetpile steel construction. Cell 2 of Alternative Plan 2a would be formed by the incorporation of the West Breakwater at Cleveland as its southerly wall. The sweeping north wall of Cell 2 would probably be constructed of fill stone and heavy breakwater stone to deflect wave action present in this unprotected area.

The U.S. Fish and Wildlife Service (Service), in coordination with the Ohio Department of Natural Resources (ODNR), has prepared this Fish and Wildlife Coordination Act Report to document the project's potential impacts upon fish and wildlife resources and to recommend measures that should be taken to conserve and protect fish and wildlife resources in light of those impacts. In general, the Service concurs that the Preferred Alternative can be developed in an environmentally acceptable manner, provided that best management practices by fully implemented in the watershed, beneficial uses of dredged spoil be fully utilized, and existing CDF's be modified to maximize their capacities.

The Service and ODNR have included a list of recommendations to incorporate into the final design and to implement during construction to significantly reduce the likelihood that the project will adversely impact species and communities of significant value. Generally, these recommendations include seasonal construction windows within which to complete work, appropriate methods of accessing the site, construction methods and structures to protect the onsite resources, requests for monitoring and adaptive management to ensure success of the project, and requests for additional information. The Service and ODNR believe that implementation of these recommendations will adequately protect the resources of concern during and after implementation of the Preferred Alternative.

II. INTRODUCTION: IDENTIFICATION OF PURPOSE, SCOPE, AND AUTHORITY

This is the U.S. Fish and Wildlife Service's (Service) draft Fish and Wildlife Coordination Act Report (FWCAR) describing the potential environmental impacts on fish and wildlife resources that may result from the U.S. Army Corps of Engineers (Corps) implementation of the "Dredged Material Management Plan at Cleveland Harbor, Cuyahoga County, Ohio" ("project"). This report constitutes the report of the Secretary of the Interior as required by Section 2(b) of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 *et seq.*).

Cleveland Harbor is dredged twice each year. The average dredging volume per year from 1998 through 2005 is 305,000 cubic yards; this includes Federal and non-Federal dredging activities.

Since the 1960's, five Confined Disposal Facilities (CDF's) have been constructed at Cleveland Harbor (9, 10B, 12, 13, and 14). The current operational CDF 10B is nearing design capacity. In accordance with joint U.S. Environmental Protection Agency (USEPA)/Corps protocols contained in the Great Lakes Dredged Material Testing and Evaluation Manual (1998), all sediment dredged from Cleveland Harbor and Cuyahoga River Channels is unsuitable for open lake and nearshore placement. All dredge material is currently disposed in a CDF.

In 1993, the Corps of Engineers initiated a program for the development of long-term plans for managing channel maintenance projects. Districts were directed to establish a Dredged Material Management Plan (DMMP) for all deep-draft navigation projects. The Buffalo District initiated the DMMP in 2003 after identifying a lack of capacity in CDF 10B. For the Corps to pursue the DMMP in Cleveland, it was necessary for the Cleveland-Cuyahoga Port Authority and the City of Cleveland to send the Corps a letter of intent expressing interest in obtaining the Corps' assistance in the planning and approval of a DMMP for Cleveland Harbor. This letter was sent on March 31, 2004. Accordingly, the Corps assumed the role of the Federal lead agency for preparation and issuance of an Environmental Impact Statement (EIS) for the proposed project, in accordance with the requirements of the National Environmental Policy Act (NEPA) of 1969.

The purpose of this report is to document the project's potential impacts upon fish and wildlife resources and to recommend measures that should be taken to conserve and protect fish and wildlife resources in light of those impacts.

Specifically, this report will describe the proposed project, describe the fish and wildlife resources within the project area, and discuss the potential environmental impact of the project on those resources, both with and without implementation of the project. At the conclusion of this report, the Service has identified mitigation measures to avoid, minimize, and compensate for project related impacts.

III. DESCRIPTION OF THE STUDY AREA

A. Location

Cleveland Harbor is located on Lake Erie at the mouth of the Cuyahoga River. The harbor is 191 miles southwest of Buffalo, NY and 110 miles east of Toledo, Ohio (Figure 1). The harbor consists of a lakefront, breakwater protected outer harbor and an inner harbor. The inner harbor is the lower deep draft section of the Cuyahoga River, and the connecting Old River. Included in the study area are the outer harbor and Cuyahoga River channels.

The outer harbor is a breakwall-protected area of about 1,300 acres. (Figure 2).The outer harbor, 5 miles long and 1,600 to 2,400 feet wide, is protected by an east breakwater (20,970 feet long) and a shore connected west breakwater (6,048 feet long). There is a 201-foot gap in the west breakwater about 662 feet from the shore end. The main entrance channel has east and west arrowhead breakwaters, both of which are 1,250 feet long. The arrowhead breakwaters are 600 feet apart.

There are two entrances to the outer harbor. The main entrance (the Lake Approach Entrance Channel) is located between the east and west breakwater. The other entrance is at the east end of the east basin, between the east breakwater and the shore. Authorized channel depths in these entrance areas are at least 29 feet below Low Water Datum (LWD). LWD for Lake Erie is 569.2 feet above mean sea level, as measured at Rimouski, Province of Quebec, Canada, IGLD 85. Authorized channel depths in the outer harbor are 28 feet below LWD in the west basin and 28 to 25 feet in the east basin.

The inner harbor includes the lower 5.8 miles of the Cuyahoga River and approximately one mile of the Old River. The Cuyahoga River is in line with the main entrance to the outer harbor from the lake. The entrance channel is protected by two parallel piers, 325 feet apart. The width of the Cuyahoga River varies from 130 to 325 feet. A turning basin is located approximately 4.8 miles upstream of the Cuyahoga River's mouth. The Old River extends westward from a point about 0.4 miles above the mouth of the Cuyahoga River. The Old River varies in width from 200 to 400 feet.

The project provides an authorized navigation channel depth of 27 feet in the lowermost part of the Cuyahoga River, from the lakeward end of the piers to a point immediately above the junction with the Old River. Authorized channel depths in the remaining portions of the Cuyahoga River are 23 feet. The Old River navigation channel is maintained to 23 and 21 feet.

IV. FISH AND WILDLIFE RESOURCES

A. Concerns and Planning Objectives

The history of shoreline disturbance and development has significantly contributed towards a reduction of the amount of suitable shoreline habitat available for use by wildlife. Diminishment of the natural vegetative communities has fragmented habitat and limited food, cover and nesting for terrestrial and avian wildlife.

Wildlife control is a significant issue in the area of the Cleveland CDFs, due to the proximity of Burke Lakefront Airport. Initially, the only wildlife control problem was with waterfowl; however, in recent years control efforts have included other wildlife species, such as white-tailed deer and coyote.

B. Federally-listed Species addressed for the Project Area

Piping Plover

The piping plover (*Charadrius melodus*) is a Federal and Ohio listed endangered species.

The following is a brief life history of the plover, taken from the Service's "Recovery Plan for the Great Lakes Piping Plover (*Charadrius melodus*)" (2003):

> The piping plover, named for its melodic call, is a small North American shorebird approximately 17 cm (6.7 in) in length (Palmer 1967) that weighs 40-65 g (1.4-2.3 oz) and has a wing span measuring about 38 cm (15 in) (Haig 1992). Light sand-colored upper plumage and white undersides blend in well with the piping plover's principal beach habitats. During the breeding season, the legs and bill are bright orange and the bill has a black tip. Other distinctive markings include a single black band across the upper breast and a smaller black band across the forehead.
>
> Piping plovers are migratory shorebirds that spend approximately 3-4 months a year on breeding grounds. In the Great Lakes region, birds begin arriving on breeding grounds in late April, and most nests are initiated by mid to late May (Pike 1985). Courtship behavior includes aerial displays, digging of several nest scrapes, and a ritualized stone-tossing display (Cairns 1977, 1982; Haig 1992). Finished nest cups are shallow depressions approximately 6 cm (2.3 in) in diameter and 2 cm (0.8 in) deep, usually lined with light-colored pebbles and shell fragments less than 1 cm (0.4 in) in diameter (Pike 1985; Perles 1995). Nest territories are actively defended by both adults. Females lay an egg approximately every other day; clutches are complete at three or four eggs. Both sexes share incubation duties that last 25-31 days (Wilcox 1959; Cairns 1977; Prindiville 1986; Wiens 1986; Haig and Oring 1988). Adults may re-nest up to four times if nests are destroyed (USFWS 1988), but in the Great Lakes region, they usually re-nest only once per breeding season (Wemmer 2000).

At Great Lakes nesting sites, eggs typically hatch from late May to late July (Lambert and Ratcliff 1981; Pike 1985). Precocial chicks usually hatch within one half to one day of each other and are able to feed themselves within a few hours. Brooding responsibilities are shared by both parents, although females may desert broods as soon as 1-2 weeks after eggs hatch (Haig 1992; Sharyn Howard, Michigan Department of Natural Resources, pers. comm., 1996). In Michigan, chicks fledge approximately 21-30 days after hatching (Wemmer 2000). Breeding adults depart nesting grounds in the Great Lakes as early as mid-July, but the majority departs by mid-August (Wemmer 2000). Juveniles usually depart a few weeks later than adults, and most disperse by late August.

Piping plovers feed primarily on exposed beach substrates by pecking for invertebrates one centimeter (0.4 in) or less below the surface (Cairns 1977; Whyte 1985). Diet generally consists of invertebrates, including insects, marine worms, crustaceans, and mollusks (Haig 1992). Bent (1929) reported the eggs and larvae of flies (Diptera) and beetles (Coleoptera), as well as crustaceans (Crustacea), mollusks (Mollusca), and other small marine animals in the stomachs of four piping plovers from Alabama. Fecal analysis revealed that piping plovers in a marine environment prey predominantly on rove beetles (Staphylinidae), snout beetles (Curculionidae), and flies (Shaffer and Laporte 1994). Cuthbert *et al.* (1999) identified freshwater prey in gizzards of four dead piping plovers salvaged from a breeding area in Grand Marais, Michigan. These chicks consumed insects from 16 different families and 6 orders; the most common orders were wasps and bees (Hymenoptera), beetles, and flies.

Piping plovers use numerous areas within breeding and wintering habitats for foraging, including wet sand in the wash zone, intertidal ocean beach, wrack lines, washover passes, mud, sand and algal flats, and shorelines of streams, ephemeral ponds, lagoons, and salt marshes (Powell 1991; Hoopes *et al.* 1992; Loegering 1992; Zonick *et al.* 1998). Areas used by piping plovers for foraging depend on availability of habitat types, prey abundance, stage of breeding cycle, and human disturbance (Cross 1990; Burger 1991; Loegering and Fraser 1995; Zonick *et al.* 1998). Several studies on the Atlantic Coast indicate that foraging habitat and food resources ultimately affect piping plover survival. In Maryland, chick survival was related to brood access to quality foraging habitats (Loegering and Fraser 1995). Goldin and Regosin (1998) found that chicks foraging in Rhode Island mudflats were more likely to survive than chicks foraging in other habitats. In New York, chicks preferred ephemeral pools, where arthropod abundance was greater than in other foraging habitats. Chick survival was also higher in areas containing ephemeral pools (Elias *et al.* 2000).

Bald Eagle

The bald eagle (*Haliaeetus leucocephalus*) is a Federally-listed threatened species, and an endangered species in the State of Ohio.

The following is a brief life history description, taken from the Service's Bald eagle species account (www.fws.gov/r9endspp/i/b/msab0h.html):

> The bald eagle is a large raptor. The characteristic adult plumage consists of a white head and tail with a dark brown body. Juvenile eagles are completely dark brown and do not fully develop the majestic white head and tail until the fifth or sixth year. Fish are the primary food source, but bald eagles will also take a variety of birds, mammals, and turtles (both live and as carrion) when fish are not readily available. Adults average about three feet from head to tail, weigh approximately 10 to 12 pounds, and have a wingspread that can reach seven feet. Generally, female bald eagles are somewhat larger than males.
>
> Breeding pairs of bald eagles unite for life or until the death of their mate. The breeding season varies throughout the U.S. but typically begins in the winter for the southern populations and progressively shifts toward spring the further north the populations occur. A typical bald eagle nest is constructed of large sticks and lined with soft materials such as pine needles and grasses. The nests are very large, measuring up to six feet across and weighing hundreds of pounds. Many nests are believed to be used by the same pair of eagles year after year. Female eagles lay an average of two eggs; however, the clutch size may vary from one to three eggs. The eggs are incubated about 35 days. The young fledge 9 to 14 weeks after hatching and at approximately 4 months the young eaglets are on their own.

In Ohio, eagles generally begin courtship and mating in January, lay eggs in February, and the eggs hatch in March or April. The young eagles remain in the nest until approximately the end of July, after which time they leave the nest and become independent. A study of fledgling eagles in Ohio's western Lake Erie basin, completed by the Ohio Division of Wildlife from 1989-1992 states that, "once independent, young eagles search out low human activity areas with good food supplies and adequate perch sites prior to migrating. The young responded to human disturbance by fleeing the area of intrusion, often by extended soaring periods." Eagles are notoriously shy and tend to avoid areas that are regularly disturbed by humans.

Eagles do not become sexually mature and nest until the age of three. Prior to this, young eagles in Ohio tend to congregate in the western basin Lake Erie marshes, including Ottawa and Cedar Point National Wildlife Refuges, Winous Point, Sandusky Bay, and Sheldon Marsh, among others (pers. comm. Mark Shieldcastle, ODNR 2003). Young eagles from Ohio, Michigan, Indiana, Wisconsin, and Canada gather in communities at these marshes. These areas generally provide enough food and roosting habitat to support a number of young eagles.

C. Fish and Wildlife Resources within the Project Area

Migratory Birds

Avifauna typically found in the CDF areas include American robin *(Turdus migratorius),* common grackle *(Quiscalus quiscula),* American crow *(Corvus brachyrhynchos),* killdeer *(Charadrius vociferous),* blue jay *(Cyanocitta cristata),* Northern cardinal *(Cardinalis cardinalis),* yellow warbler *(Dendroica petechia),* American goldfinch *(Carduelis tristis),* house finch *(Carpodacus mexicanus),* house sparrow *(Passer domesticus),* European starling *(Sturnus vulgaris),* tree swallow *(Iridoprocne bicolor),* mourning dove *(Zenaida macroura),* and rock dove *(Columba livia).* Waterfowl and shorebirds utilizing the harbor and shoreline likely include mallard *(Anas platyrhnchos),* Canada goose *(Branta Canadensis),* American black duck *(Anas rubripes),* species of gulls, terns, and shore and wading birds such as sandpipers, plovers, yellowlegs *(Tringa* spp.*),* rail *(Rallus* spp.*),* great blue heron *(Ardea herodias)* and similar species. In addition, other predatory birds such as owls and hawks likely pass through the area.

Wildlife control is a significant issue in the area of the Cleveland CDFs, due to the proximity of Burke Lakefront Airport. The Airport currently employs a wildlife biologist with the USDA Animal and Plant Health Inspection Service to control wildlife at Burke. Bird strikes at Burke caused approximately $4 million in damage to aircraft in 2002. The major problem/hazard species that utilize this area include: Bonaparte's gull (*Larus philadelphia*), herring gull (*Larus argentatus*), ring-billed gull (*Larus delawarensis*), Canada goose, greater scaup (*Aythya marila*), lesser scaup (*Aythya affinis*), red-breasted merganser (*Mergus serrator*), mallard, mute swan (*Cygnus olor*), double-crested cormorant (*Phalacrocorax auritus*), Caspian tern (*Sterna caspia*), great blue heron, killdeer, red-winged blackbird (*Agelaius phoeniceus*), American kestrel (*Falco sparverius*), eastern meadowlark (*Sturnella magna*), European starling, mourning dove, and red-tailed hawk (*Buteo jamaicensis*).

Interjurisdictional Fish

Cleveland Harbor provides habitat for a variety of forage and game fish. The central basin of Lake Erie is known for its excellent year-round sport fishing. Species such as alewife *(Alosa pseudoharengus),* gizzard shad *(Dorosoma cepedianum),* brown bullhead (*Ictalurus nebulosus),* white perch *(Morone americana),* yellow perch *(Perca flavescens),* smallmouth bass *(Micropterus dolomieue),* largemouth bass (*M. salmoides),* pumpkinseed *(Lepomis gibbosus)* and black crappie *(Pomoxis nigromaculatus)* may utilize habitats in the project vicinity for spring reproductive activities. In addition to the above, species such as northern pike (Esox lucius), walleye *(Stizostedion vitreum),* white bass *(Morone chrysops),* various sunfish *(Lepomis* sp.*),* and various forage fish may be found near the project site (USACE 2006a).

The fish community within the Cuyahoga River navigation channel consists mainly of tolerant and moderately tolerant species. Based on electrofishing collections between 1984 and 1994, fish species in the navigation channel consists mainly of gizzard shad, emerald shiner (*Notorpis atherinoides*), common carp (*Cyprinus carpio*), white perch

(*Morone americana*), goldfish (*Carassius auratus*), and brown bullhead (*Ictalurus nebulosus*). White bass, spottail shiner (*Notropis hudsonius*), and pumpkinseed were also present along with 19 other species collected sporadically in low numbers and are considered transients.

For your information, the Appendix includes biological and water quality data in select figures and tables from Ohio EPA's 1999 *Biological and Water Quality Study of the Cuyahoga River and Selected Tributaries.*

Zooplankton and Benthic Organisms - It is expected that several species of invertebrates use the nearby lake bottom around the project site for foraging and breeding. Such species include benthic (aquatic earthworms), chironomids (midges) and mollusks (fingernail clams). Other invertebrates include crustaceans, such as isopods and scuds, snails, and leeches. It should be noted that the invertebrate information is based on Ohio EPA sampling with Hester-Dendy multi-plate sampler. Therefore, larger invertebrates, such as crayfish and mussels were not sampled. If such data do not exist, we recommend that the Cleveland Harbor be sampled for these larger invertebrates, using maintenance dredging funds.

Phytoplankton - Phytoplankton composition in the vicinity of Cleveland Harbor consists of the following dominant algal groups: Baccillariophyta (diatoms), Chlorophyta (green algae), Chrysophyta (Chrysophytes), and Cyanophyta (blue green algae).

Species of Concern The Ohio Department of Natural Resources (ODNR) indicates that it has old State species records stating that the following species could lie within the proposed project area: muskellunge (*Esox masquinongy*), upland sandpiper (*Bartramia longicauda*), and Richardson's pondweed (*Potamogeton richardsonii*).

Reptiles, Amphibians, and Mammals

Fauna found in the Cleveland vicinity includes the leopard frog and green frog *(Rana pipiens* and *R. clamitans,* respectively), northern watersnake *(Nerodia sipedon),* and snapping turtle *(Chelidra serpendina).* Mammalian species that may occur near the project area include the coyote (*Canis latrans*), eastern chipmunk *(Tamias striatus),* house mouse (*Mus musculus),* Norway rat *(Rattus norvegicus),* muskrat *(Ondrata zibethica),* striped skunk *(Mephitis mephitis),* opossum *(Didelphis marsupialis),* raccoon *(Procyon lotor),* white-tailed deer *(0docoileus virginiana),* hairy-tailed vole *(Parascalops breweri),* star-nosed mole *(Condylura cristata),* cottontail rabbit *(Sylvilagus floridanus),* and prairie vole *(Microtus pennsylvanicus).*

Vegetation

Most of the existing CDF sites are heavily vegetated with common reed *(Phragmites australis)* which is mowed annually when conditions are dry enough to allow entry by equipment. Trees that occur naturally near the waterfront include black willow (*Salix* *nigra*), staghorn sumac (*Rhus typhina*), eastern cottonwood (*Populus deltoides*), black locust (*Robinia pseudoacacia*), and green ash (*Fraxinus pennsylvanica*).

V. PROJECT DESCRIPTION

The primary objective of Cleveland Harbor DMMP is to maintain adequate navigation depths within the authorized Federal navigation channel of Cleveland Harbor.

Historically, the Corps has employed a number of dredged disposal methods for sediments dredged from the Federal channels at Cleveland including unconfined open-water placement and in recent years, disposal into a Confined Disposal Facility (CDF). A CDF refers to a site where specific dredged materials are confined in an enclosed space, due to the potential for release of contaminants into open-water. Confined Disposal Sites can be located upland, adjacent to upland, or as an island along the lakeshore. In practice, due to the high costs of over-land transportation of dredged sediments, most CDF's are located along the lakeshores of the Great Lakes.

Since the late 1960's, several CDF's have been constructed in-lake adjacent to the shore at Cleveland Harbor. Currently, CDF 10B is being utilized for disposal of dredge materials. This CDF opened for operation in 1998. The Corps' projection in 2006 indicated that the facility would be filled to capacity that year.

A. Alternative Management Measures

Management measures can be combined in various fashions to formulate alternative plans. Management measures can be both structural and non-structural in nature. The management measures developed to date for this study by the Corps are described below.

Measure A - No Action - Under this measure, the Federal Government would do nothing to address the need for future long-term placement of dredged material. When the Fill Management Plans have been fully implemented for CDF's 10B and 12 in the year 2014, no further dredging would occur in Cleveland. Without dredging, the navigation channel would progressively shoal in and impede commercial navigation. Deep-draft commercial navigation would become economically non-viable and gradually cease. Consistent with USACE guidance (ER 1105-2-100), **this measure will be carried forward into detailed planning and fully evaluated in the array of final plans**.

Measure B - Beneficial Use - Beneficial use of dredged material includes recreation, agricultural, and habitat development, beach nourishment, and innovative engineering alternatives such as manufacture of soils from dredged materials. Consolidated dredged materials could be mined from existing Cleveland Harbor CDF's and used elsewhere for beneficial purposes, or materials dredged on a yearly basis could be dewatered and used for beneficial purposes. In either event the need for future confined disposal sites placed in the lake could be minimized. In order to successfully implement beneficial uses, the alternative must be technically and economically feasible, obtain public support, and address legal and regulatory issues. The quality of dredged materials from Cleveland Harbor tends to be somewhat contaminated, thus limiting the possibilities for Beneficial Use plans; however, **the Beneficial Use Measure will be carried forth into detailed planning for the Cleveland DMMP**.

Measure C - Open-Lake Placement - A designated open-lake disposal site for Cleveland Harbor is located 9 miles east of the north breakwater. This site has not been used for many years due to the contaminated nature of the dredged material from Cleveland Harbor. In accordance with joint U.S. Environmental Protection Agency (USEPA)/Corps protocols contained in the Great Lakes Dredged Material Testing and Evaluation Manual (1998), all sediment dredged from Cleveland Harbor and Cuyahoga River Channels in recent years has been unsuitable for open-lake placement. As discussed previously, it does not appear that there will be any significant improvement in the quality of sediments to be dredged from Cleveland Harbor during the future 20-year period of this analysis. Therefore, **Open Lake Placement has been eliminated from further evaluation in this study.**

Measure D - New Confined Disposal Facility (CDF) - The construction of new in-water confined disposal sites adjacent to the Cleveland shoreline and/or existing navigation structures at Cleveland has been proven doable and successful. Therefore, **this measure will be carried forward for further planning and evaluation.**

Measure E - Management of Existing Confined Disposal Facilities to Extend Their Useful Life - The Corps' Buffalo District has constructed a number of in-lake CDF's that have been filled or are essentially filled. These facilities can be managed to extend their useful lives to accept dredged materials, particularly during the period 2007 until 2013. Therefore, **this measure will be carried forward for further planning and evaluation.**

Measure F - Best Management Practices - For the purposes of the Cleveland DMMP, BMP's would be generally designed to reduce sediment loads to the watershed and eventually to the Federal channels requiring dredging. The Cuyahoga River, like many major rivers across the country, is being impacted by significant landscape alterations throughout the entire watershed, not just in the industrialized areas. These impacts are caused by the way the landscape is used for urban, suburban and rural activities. Land disturbances associated with high residential growth rate and intensive agricultural practices are a particular problem. The sub-basins of the Cuyahoga River watershed have had more than 20 percent of their lands eroding at a rate of 5 tons/acre/year, or more. Over 17,000 acres are eroding at "excessive" levels in these areas with cropland accounting for 82 percent of this number. Ideally, a buffer strip of natural vegetation (a riparian corridor of trees, shrubs, and grasses) along the river and streambanks protects against the eroded material from washing quickly into the river. Unfortunately, in many areas of the Cuyahoga River and its tributary systems, there has been considerable disruption of the natural riparian corridor. Without an intact vegetative buffer, significant amounts of non-point source pollution (runoff) enter the Cuyahoga River and its tributaries.

The entire Cuyahoga River watershed has been designated as an Area of Concern. Great Lakes Areas of Concern (AOCs) are severely degraded geographic areas within the Great Lakes Basin. The U.S.-Canada Great Lakes Water Quality Agreement (Annex 2 of the 1987 Protocol) defines AOCs as "geographic areas that fail to meet the general or specific objectives of the agreement where such failure has caused or is likely to cause impairment of beneficial use of the area's ability to support aquatic life." The Cuyahoga River Remedial Action Plan Coordinating Committee together with the Ohio Environmental Protection Agency are working together to address detrimental land-use practices and the associated non-point source pollution. **Best Management Practices will be carried into detailed planning.**

B. Alternative Plans under Development

Alternative Plan 1 (Measure A defaults to Measure E) No Action - No Action implies that no long-term measure for management of dredged material from Cleveland Harbor will be found. For the short term (2007-2013), the Corps would implement the components of Measure E management with the existing CDF's at Site 10B and 12. After 2013, no disposal facility or method would be available for Cleveland, and the Corps would cease further dredging and disposal.

Alternative Plan 2 (Measure B and E) Beneficial Use of Dredged Material and Existing CDF Management - This alternative would involve the implementation of Measure E for the disposal of dredged material in existing CDF's 10B and 12 for the period 2007 through. 2013. From 2014 through 2026, yet-to-be-determined beneficial uses of dredged materials would be implemented to provide for the yearly disposal of 330,000 cubic yards of dredged materials.

Alternative Plan 3 (Measure E and D) Managing Existing CDF's to Extend Their Useful Lives While Planning for a New CDF With a minimum 14-Year Capacity - Plan 3 involves implementing Measure E for the period 2007 through 2013 and construction of one or more in-water Confined Disposal Sites (Measure D) in Cleveland Harbor to accommodate dredged materials for a minimum of 13 years (2014 through 2026). A number of alternative in-water CDF locations have been developed during this study and are discussed in the following sections.

CONSTRUCTION OF NEW CDF

To minimize construction costs, a new facility would likely be sited adjacent to existing harbor navigation structures (i.e., piers, breakwaters) or adjacent to an existing CDF. Eight new CDF locations are being considered, as listed below, and illustrated on Figure 3.

Site 1: East of Edgewater State Park
Site 2: North of the West Breakwater

Site 3: North of the East Breakwater
Site 4: Immediately west of Dike 10B
Site 5: Immediately south of Dike 12
Site 6: Immediately east of Dike 12
Site 7: Northeastern, most point of the East Breakwater
Site 8: Immediately north of Dike 14

Action Alternatives for Construction of New CDF

Action Alternative A. Site 1. East of Edgewater State Park
Action Alternative B. Site 2. North of the West Breakwater
Action Alternative C. Site 3. North of the East Breakwater on the west end
Action Alternative D. Site 6. Immediately east of CDF 12

PREFERRED ALTERNATIVE PLAN

Recently, the Service received information from the Corps regarding its Preferred Alternative Plan, as it presently exists. The following is a description of that plan.

Alternative Plan 2a

Alternative Plan 2a would involve the construction of a two celled CDF, as illustrated in Figure 4. Cell 1, to be constructed and available for disposal of dredged material in 2012, would be approximately 50 acres in size. It would be formed on the north side by incorporation of the existing West Breakwater at Cleveland. To the east and south, Cell 1 would be formed by the construction of new perimeter walls, probably of sheetpile steel construction. This cell would be subdivided, as necessary, to improve the operational aspects of dredged material disposal. Ultimately, Cell 1 would be turned over to the non-Federal sponsor for relocation of facilities of the Cleveland-Cuyahoga Port Authority. Cell 1 would be designed to have a life of about 7 years, assuming the average annual disposal of about 330,000 cubic yards (about 2,300,000 cubic yards total). Upon filling of subcells within Cell 1, the Port Authority would stabilize the fill in Cell 1 with additives (stone, coal byproducts, etc.) to provide a firmer foundation for construction of storage buildings and open-air port handling facilities.

Cell 2 of Alternative Plan 2a would be formed by the incorporation of the West Breakwater at Cleveland as its southerly wall. Cell 2 would be constructed and available for use for the disposal of dredged material in 2019. It would be designed to have a rough capacity of 3,630,000 cubic yards, or a life of 11 years at 330,000 cubic yards per year. The sweeping north wall of Cell 2 would probably be constructed of fill stone and heavy breakwater stone to deflect wave action present in this unprotected area. At this time, no ultimate use has been suggested for Cell 2, although it could be used for expanded port facilities or could be modified to serve as an offshore refuge for migratory birds and other wildlife.

C. Impacts of Alternatives on Fish and Wildlife Resources

To minimize impacts to lacustrine and lakeshore habitat, disposal of dredged materials should ideally be placed in upland areas along the lake. We understand that costs and other impacts would be prohibitive to have upland disposal. Further, we understand that open-lake disposal of dredged material from the navigation channel and harbor is not possible, due to contaminants in the sediments. Therefore, to maintain commercial navigation in the harbor and navigation channel, facilities to spoil dredged material must be constructed in the harbor area, while pursuing to the maximum extent efforts to reduce sediment input into the Cleveland Harbor. This results in permanent destruction of aquatic habitat. In the past this habitat was degraded; however, in recent years water quality has improved in areas where CDF's would be located. In turn, the fishery resource has improved, albeit still lacking full attainment of Clean Water Act goals.

ALTERNATIVE MANAGEMENT MEASURES EVALUATED

Measure A – No Action

We understand the implications of the No Action alternative; that is, this alternative would result in the cessation of commercial navigation in the Cleveland Harbor. Nevertheless, we support the Corps' decision to carry forward this measure into detailed planning.

Measure B – Beneficial Use

The Service supports and believes that the beneficial uses of dredged material should be continually explored and implemented when and where feasible. Relative to our interests, we fully support the use of dredged material for wildlife habitat development in a natural setting.

Measure C – Open Lake Placement

We understand that the material being dredged has a high probability of containing contaminants, and therefore, the placement of this material in the open lake would not be appropriate

Measure D – New CDF

Frankly, this measure would result in the greatest impact to mostly aquatic resources in the nearshore area. For this reason we are recommending that other measures, chiefly B, E, and F, be fully implemented to at least delay the need for this measure.

Measure E – Management of Existing CDF's to Extend Their Useful Lives

We support this measure, since it would result in significantly less adverse impact to the fish and wildlife resources than Measure D.

Measure F – Best Management Practices

Definitely, this measure must be given more than lip service treatment. We would like to see a concerted effort to maximize the benefits of an interagency program of implementing Best Management Practices in the Cuyahoga River Watershed.

A couple decades ago the Service provided a FWCA report on similar activities in the Toledo Harbor area of Lucas County. The conclusion was that if a similar amount of money (maintenance dredging costs) were spent on BMP-implementation in the watershed, significant reduction of dredging to maintain commercial navigation could be realized. In 1995, the Corps and the Natural Resources Conservation Service entered into a partnership and a two-year pilot project to demonstrate the effectiveness of an extensive land treatment erosion control program to reduce the source of sediment. Over 22 counties in the Maumee Watershed participated. Counties used the funding to promote conservation tillage and other practices which would reduce sediment delivery to the harbor. After two years, approximately half of the goal still remains to be achieved. The project report concludes that two years in not enough time to effect the long term changes needed to see actual results in the harbor. It is confident that goals can be achieved and recommends a six-year project funded at the levels originally proposed, with additional funding to accelerate the Conservation Buffer Initiative within the watershed. Finally, the report proposes a Trust Fund for the Harbor to maintain project accomplishments long term.

A similar program in the Cuyahoga River watershed should involve voluntary and mandatory steps to, not only curb soil erosion rates in the watershed through the use of BMP's, but also actions to reestablish buffer strips along all waterways in the watershed. Such program should involve Federal agencies, such as the Corps of Engineers, Natural Resource Conservation Service, U.S. Fish and Wildlife Service, U.S. Geological Survey, National Park Service, and U.S. Environmental Protection Agency (EPA); and State and local agencies, such as Ohio Department of Natural Resources, Ohio EPA, Ohio Department of Agriculture, and county(s) Soil and Water Conservation Districts, among other entities.

It must be stated that erosion is a natural process and therefore, cannot be totally stopped. However, a concerted effort by multiple agencies and the private sector should significantly reduce the volume of dredged material in the Cleveland Harbor. We recommend that the Corps act as a lead agency among Federal, State, and local agencies in an effort to implement, to the maximum extent possible, Measure F.

EVALUATION AND COMPARISON OF ALTERNATIVE PLANS

Alternative Plan 1

We understand that pursuit of the No Action alternative would default Measure A to E. In other works, "No Action" would result in management changes to existing CDF's to extend their lives. We believe that Measures B and F must be included with Measure E equally. Again, these measures should be given more than lip service!

Alternative Plan 2

As in Plan 1, Measure F should be an integral component with Measures B and E.

Alternative Plan 3

As with previous alternative plans, Measures B and F must be equal components in this alternative plan for the reasons mentioned above.

NEW CDF SITE EVALUATION

The Corps provided the Service with a list of possible sites for construction of a new CDF. They are listed above in section *B. Alternative Plans under Development*. For various reasons several of the sites were eliminated from consideration. The Service had concerns with at least two (Sites 4 and 5), due to possible bird strikes associated with airport activities. Of the total list of possible sites, the Corps considered four to be "Action Alternatives."

- Site 1 is east of Edgewater State Park
- Site 2 is north of the West Breakwater
- Site 3 is north of the East Breakwater, on the west end by the channel opening
- Site 6 is immediately east of Site 12

We consider the sites outside of the confines of Cleveland Harbor to be more valuable aquatic habitat, due to water quality issues within Cleveland Harbor. Therefore, of the four sites, we believe that the construction of a CDF at Site 6 would have the least impact to the fishery resources. On the other end of the impact spectrum, we believe a CDF development at Edgewater Park would have the most impact to those resources, since this site is in a nearshore area without obstructions to the open lake. Sites 2 and 3 would be in the middle of the impact scale.

Fortunately, the current Preferred Alternative Plan (2a) includes a reduced area north of the West Breakwater and a small area south of the same breakwater (Alternative Plan 2a is described in more detail above). We believe this modified alternative to Site 2 would be preferred to the original Site 2. Our evaluation of the degree of impacts associated with each of the four sites is somewhat subjective. The bottom line is that construction of a CDF at any of the four sites would have similar impacts and would result in the permanent loss of a similar sized area of aquatic habitat.

VI. FISH AND WILDLIFE CONSERVATION MEASURES

A. Discussion

To maintain a viable commercial shipping industry in Cleveland, we understand that a maintenance dredging program must continue. Without it, areas of the Cleveland Harbor and navigation channel of the Cuyahoga River would become too shallow for ships to pass safely.

In an effort to minimize the need to construct new CDF's in the harbor area, the Corps addressed several measures to mitigate this need. These measures include beneficial uses of dredged material, management of existing CDF's to extend their lives, and the use of BMP's in the watershed to reduce the volume of material required for dredging. We believe it is imperative that the Corps directly, or through its influence, maximize the use of these measures before initiating the construction a new CDF. It appears that modification of existing CDF's to accommodate more spoil material will be a necessity, due to immediate need. Fully implementing BMP's in the watershed would be dependent on national and local funding of many conservation projects that provide erosion reduction benefits, and the Corps, through the Water Resources Development Act and other authorities, is in a position to affect this funding.

There has been discussion in Corps documents about final use of filled CDF's. One site would be used by the Airport Authority for its activities. For another site, the possibility of managing it as a wildlife sanctuary was mentioned. Except for the airport areas, we believe that CDF's should be managed for wildlife, preferably wetland habitat. We acknowledge this would be a change in habitat type (deepwater to wetland); however, such management would offer at least partial mitigation for the loss of aquatic habitat (with construction of a new CDF).

As always, maintenance dredging activities should be timed to minimize impacts to fish during the spawning period. The Ohio DNR, Division of Wildlife should be consulted for information restricting dredging activities which would be detrimental to spawning fish.

Similar to implementation of BMP's in the watershed to reduce soil erosion, BMP's should be fully implemented with the maintenance dredging activity. The 1998 Great Lakes Dredged Materials Testing and Evaluation Manual and other guidance should be used to support such implementation.

In the past the Service has made recommendations that the Corps construct a fish spawning shelf along any new dikes associated with new CDF construction. This feature would serve as partial mitigation for the loss of fishery resources in the area proposed for CDF construction. Figure 5 generally illustrates the design for this shelf. The shelf should be about six feet wide, with varying widths and depths. The support for the shelf should be constructed of stone, with the shelf itself consisting of clean gravel. We would be pleased to meet with the Corps and Ohio DNR staffs to further discuss the feasibility of this recommendation. We understand that shallow water habitat with desirable substrate for fish spawning is lacking in this portion of the lake.

The continued reduction of high quality habitat in Lake Erie by small increments should be addressed in subsequent documents. At one time conservation of the great eastern forests did not seem necessary, because the resource appeared to be inexhaustible. Now, of course, we know the eastern forests did have limits, and that if the continued destruction of its habitat is not kept in check, eventually this habitat will also become limited or threatened. Likewise, with the Great Lakes, the amount of freshwater habitat may have seemed inexhaustible. Yet, as our population grows and more impacts occur to the lake habitat, eventually short-sighted solutions (usually the cheapest from a narrow-minded perspective) have to be replaced with long-term "permanent" solutions.

B. List of Recommendations

1. Fully implement BMP's in the watershed to minimize the volume of eroded materials entering the Cleveland Harbor (regardless of alternative plan pursued). This can be accomplished through WRDA, CREP, and/or CRP programs, as well as programs associated with other agencies, such as U.S. Geological Survey and State and Federal Environmental Protection Agencies.

2. Maximize utilization of existing CDF's to forestall the need for construction of a new facility.

3. Fully explore the possibilities of beneficial use of dredged material in the Cuyahoga River watershed area (regardless of alternative plan pursued). Implement the feasible beneficial uses, either from barged loaded with fresh dredged materials or from consolidated materials on CDF's.

4. Fully implement BMP's during maintenance dredging operations to minimize impacts to water quality in the harbor.

5. Fully implement BMP's during any possible construction activities to increase capacity at an existing CDF, or a new CDF.

6. Except for CDF's near the airport, we recommend that CDF's be managed for wildlife as mitigation during intervals of non-activity, if feasible, and after final filling of the CDF. Management efforts should be coordinated with Ohio DNR Division of Wildlife and the Service.

7. We recommend consultation with the Ohio DNR regarding seasonal restrictions of dredging activities to protect the fishery resource during the spawning period, in particular.

8. We recommend that our proposal to construct fish spawning shelves along the outside of newly constructed CDF dikes be fully explored regarding need and feasibility. This feature would serve as partial mitigation for loss of fishery habitat in the Cleveland Harbor area.

VII. List of References and Relevant Prior Studies/Reports

Ohio EPA. 1999. Biological and Water Quality Study of the Cuyahoga River and Selected Tributaries.

Shieldcastle, Mark. 2003. Personal Communication. Ohio DNR Div. of Wildlife

USACE. 1974. Final Environmental Impact Statement (FEIS)*, Operation and Maintenance, Cleveland Harbor, Ohio.

USACE. 1983. Supplemental Information Report and Section 404(b)(1) Evaluation, Operation and Maintenance, Dike Site 14, Cleveland Harbor, Ohio.

USACE. 1984. Supplemental Information Report and Section 404(b)(1) Evaluation, Operation and Maintenance, Lake Erie Littoral Drift Nourishment, Bratenahl and Perkins Beach, Ohio.

USACE. 1994. FEIS*, Harbor Maintenance and Confined Disposal Facility Site 10B, Cleveland Harbor, Ohio.

USACE. 2004. Finding of No Significant Impact and Environmental Assessment, Reuse of CDF 12, Cleveland Harbor.

USACE. 2006. Cleveland Harbor, Ohio Dredged Material Management Plan Issue Resolution Conference Documentation (May 24, 2006).

USFWS Division of Endangered Species. 1999. Bald Eagle Species Account. 9/27/99. Website: http://www.fws.gov/r9endspp/i/b/msab01.html

USFWS. 2003. Recovery Plan for the Great Lakes Piping Plover (*Charadrius melodus*).

* The U.S. Fish and Wildlife Service's Fish and Wildlife Coordination Act report is included in this FEIS.

VIII. APPENDIX

Selected References from Ohio EPA's Biological and Water Quality Study of the Cuyahoga River and Selected Tributaries, Volume 1 and 2 (August 15, 1999)

Selected Figures and Tables from the above document focus on data from the lower Cuyahoga River and/or the navigation channel.. Accordingly, some portions of tables showing data from the upper or mid-reaches of the Cuyahoga River were not included.

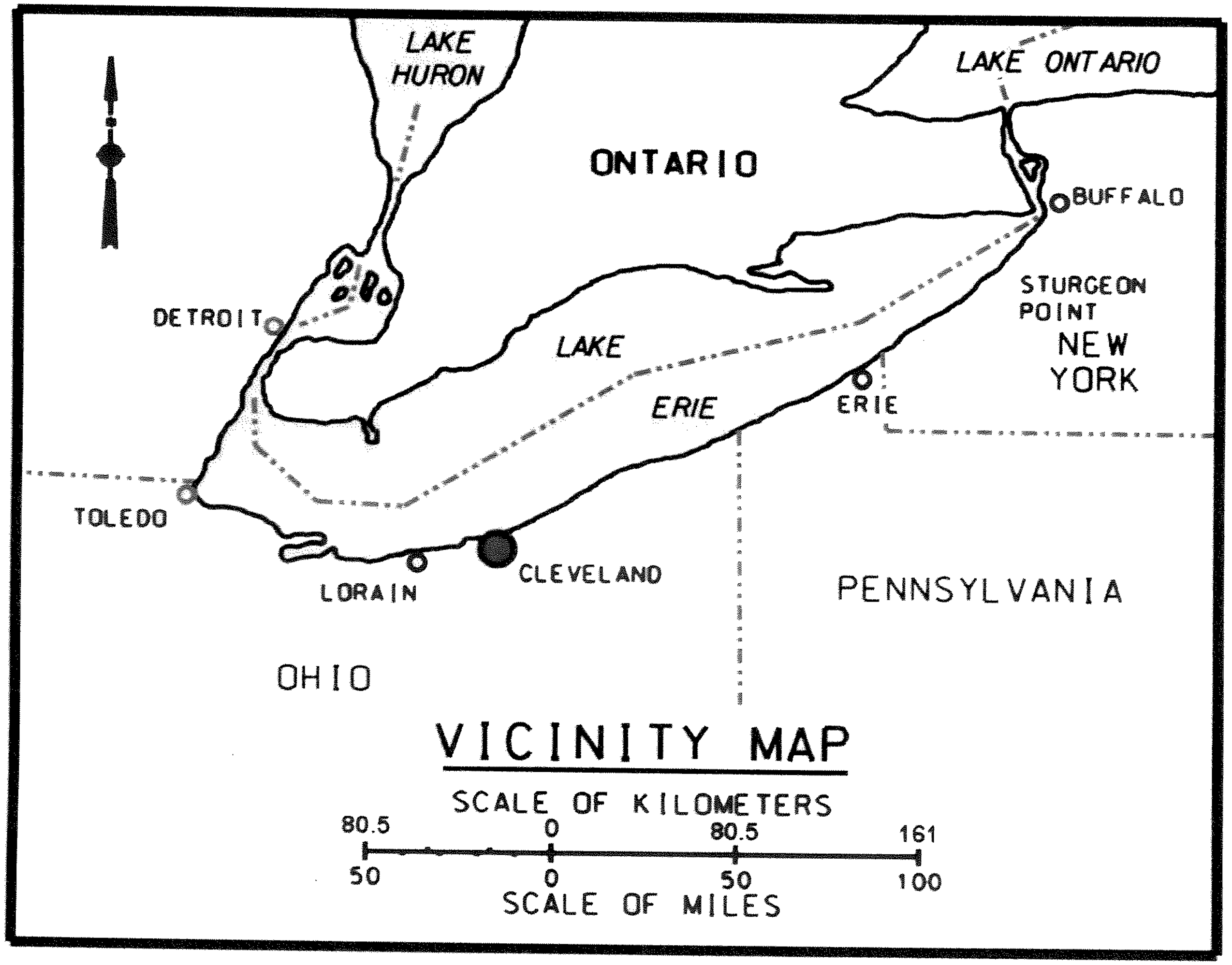


Figure 1. Cleveland Harbor: General Project Location

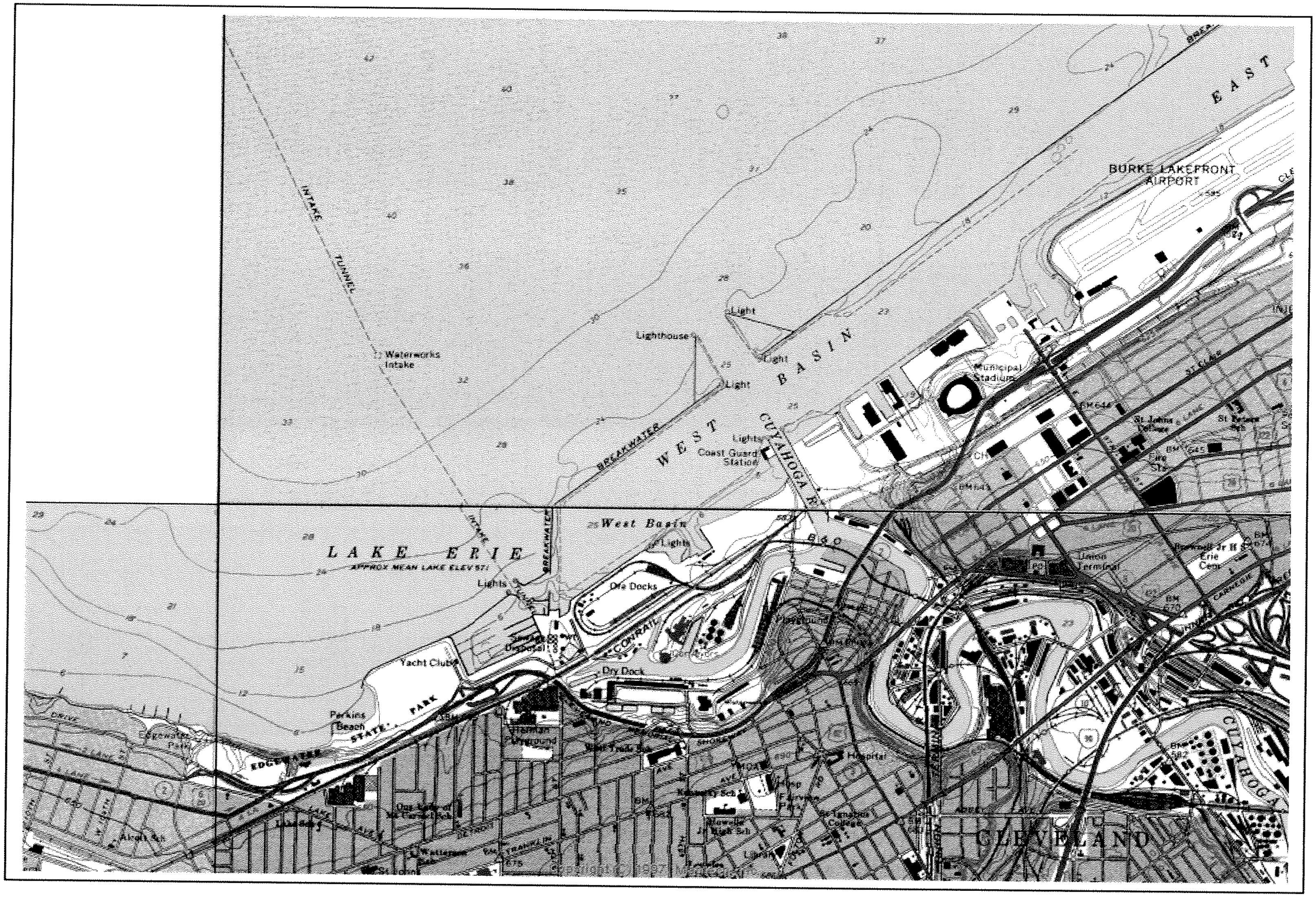


Figure 2. Cleveland Harbor and Cuyahoga River Navigation Channel

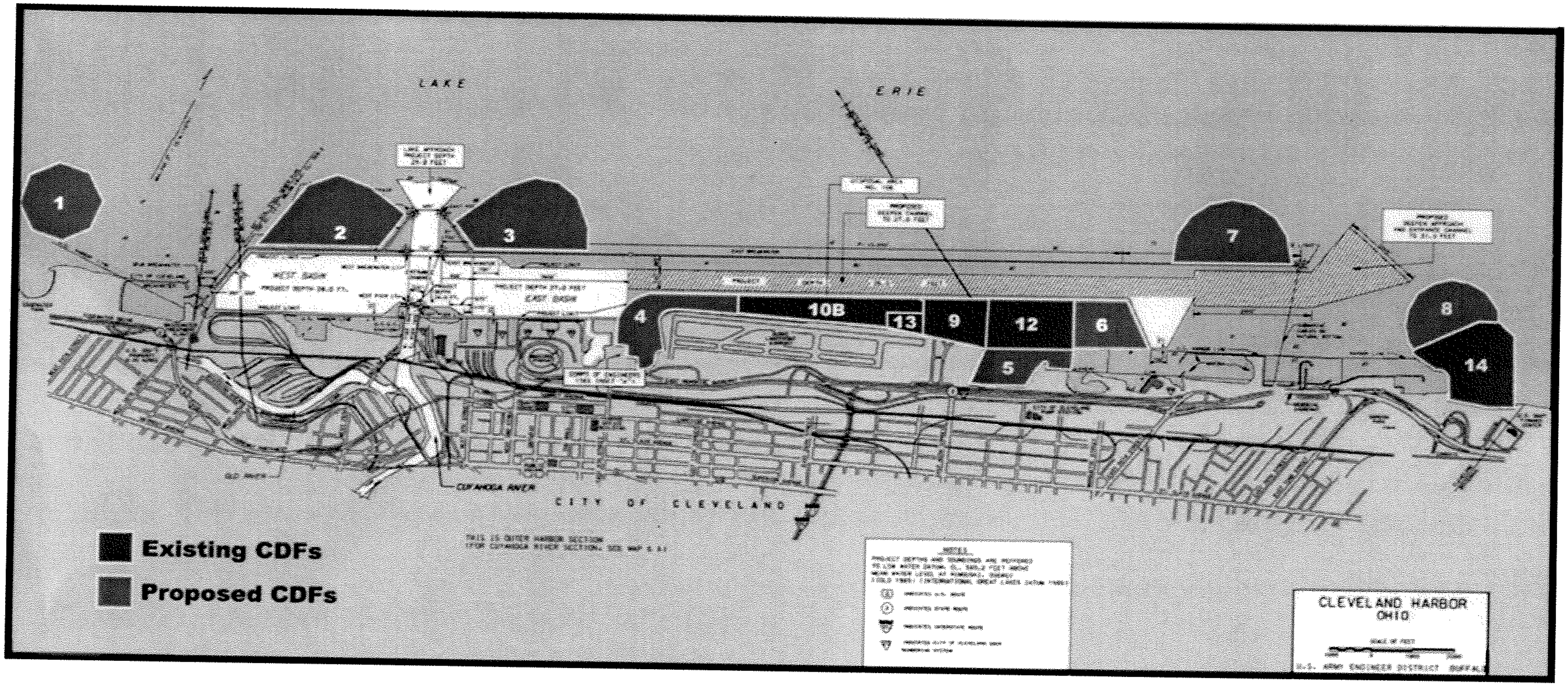


Figure 3. Cleveland Harbor: Existing and Proposed CDF's

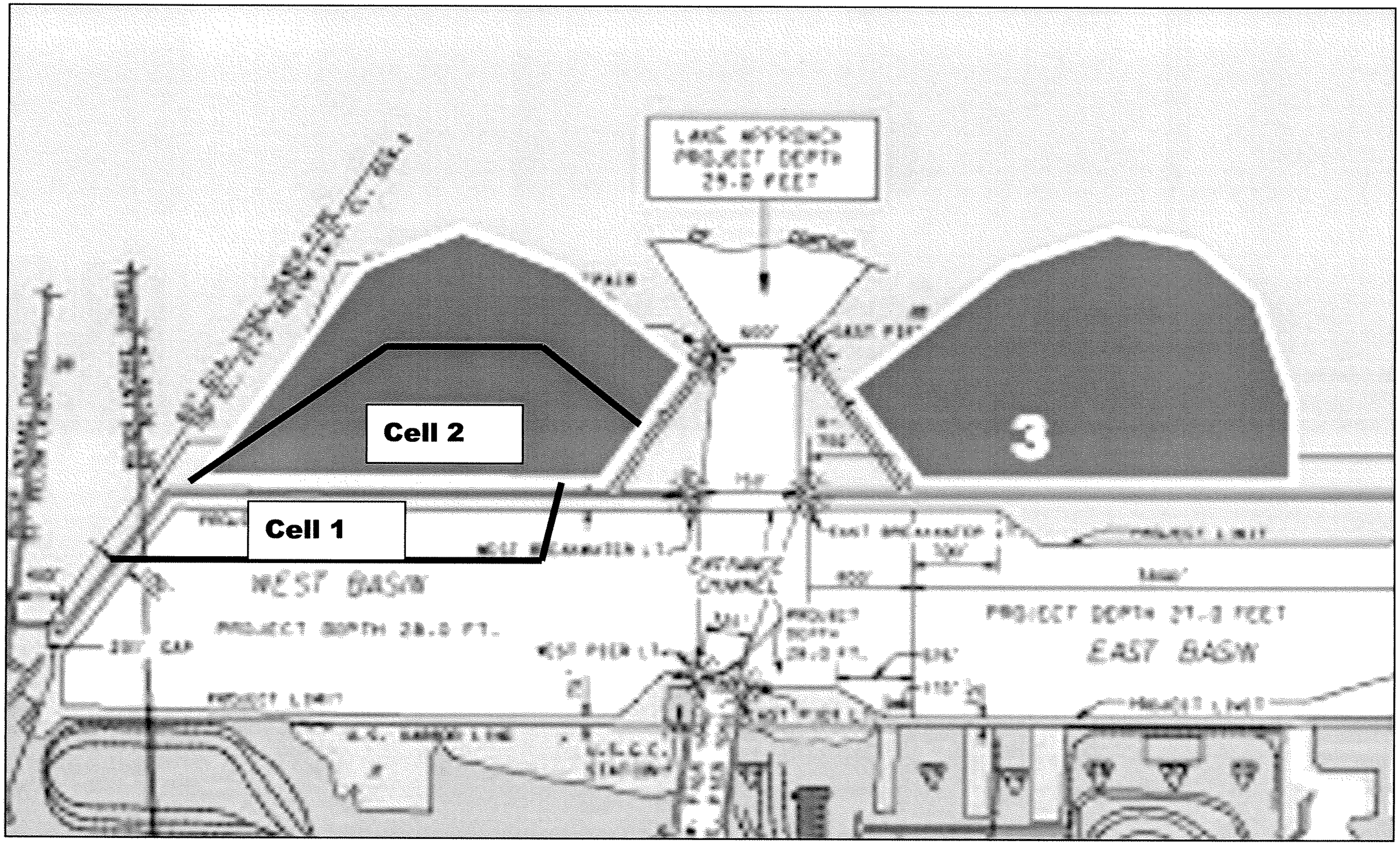


Figure 4. Cleveland Harbor Alternative Plan 2a: two-celled CDF adjacent to West Breakwater

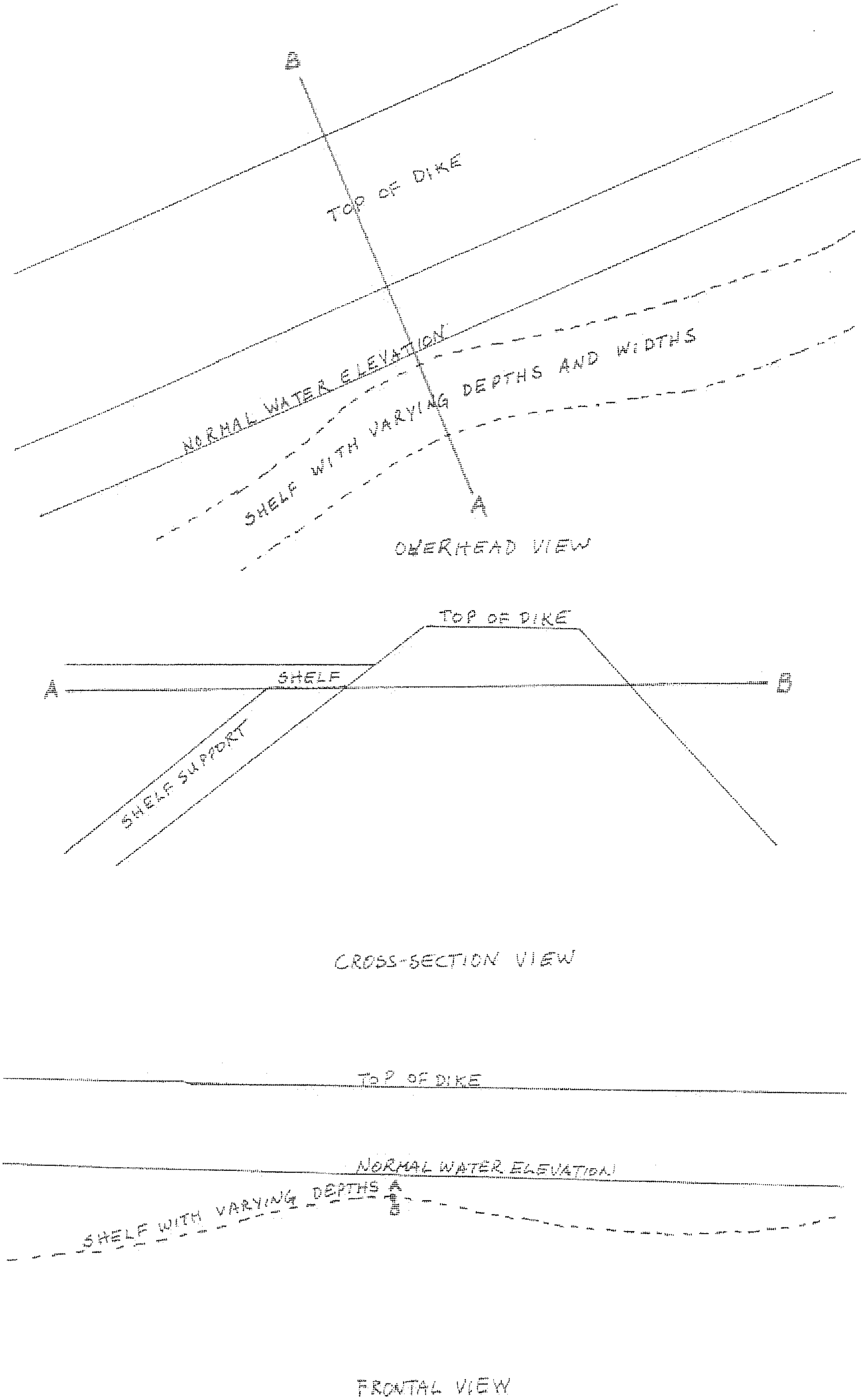


Figure 5. General design for proposed fish spawning shelf along dikes of new CDF.

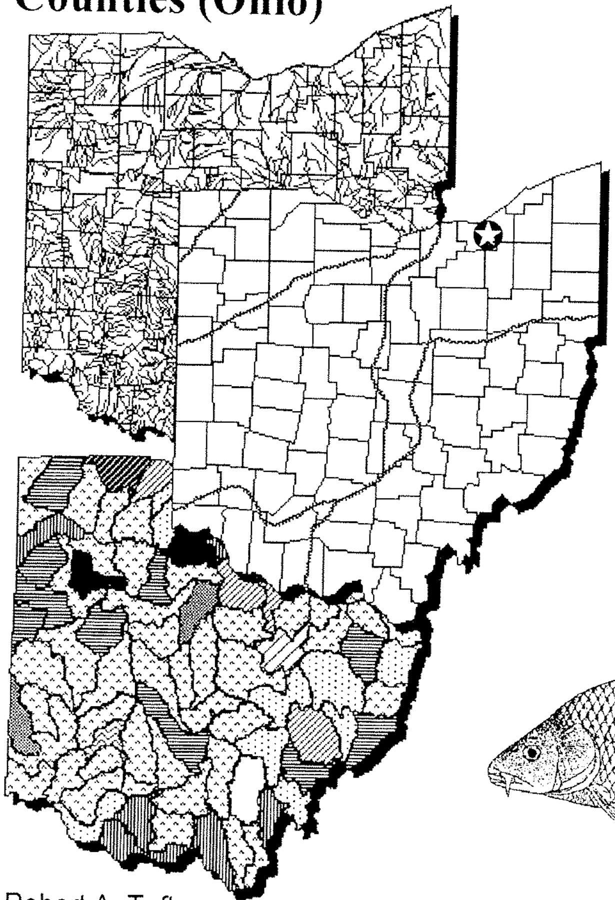
State of Ohio
Environmental Protection Agency

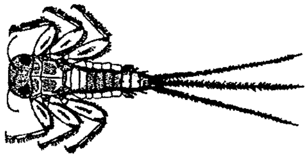
Ecological Assessment Unit
Division of Surface Water

Biological and Water Quality Study of the Cuyahoga River and Selected Tributaries

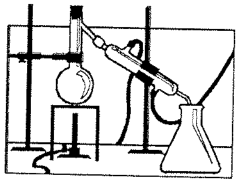
Volume 1

Geauga, Portage, Summit, and Cuyahoga Counties (Ohio)

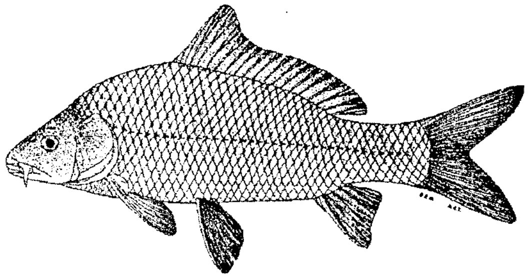




Mayfly *(Stenonema)*



Chemical Analysis



Common Carp *(Caprodes carpio)*

Robert A. Taft
Governor, State of Ohio
Christopher Jones
Director, Ohio Environmental Protection Agency

August 15, 1999

P.O. Box 1049, Lazarus Government Center, 122 South Front Street, Columbus, Ohio 43266-1049

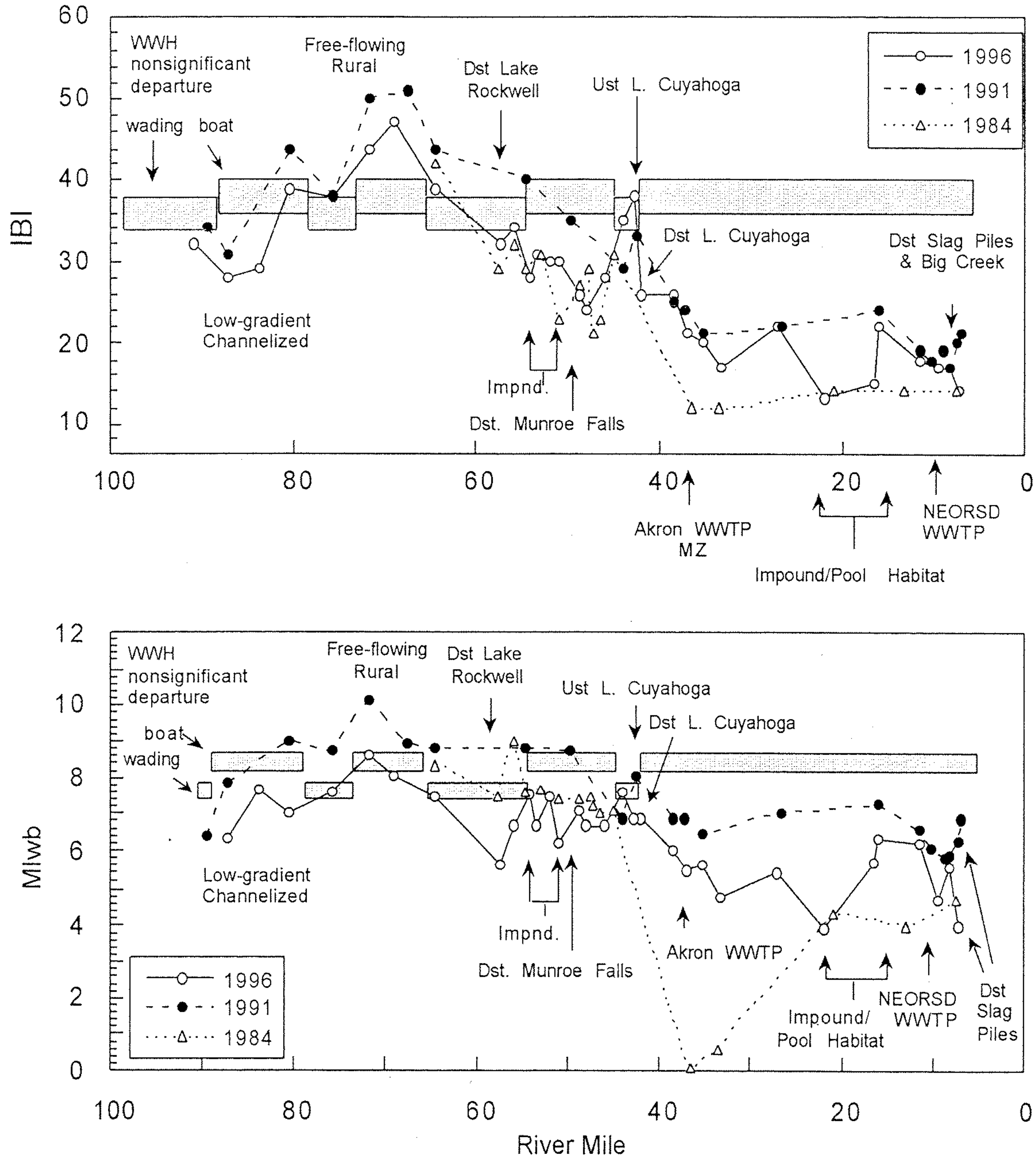


Figure 11. Longitudinal trend of the Index of Biotic Integrity (IBI) and Modified Index of Well-Being (MIwb) in the Cuyahoga River, 1984, 1991, and 1996

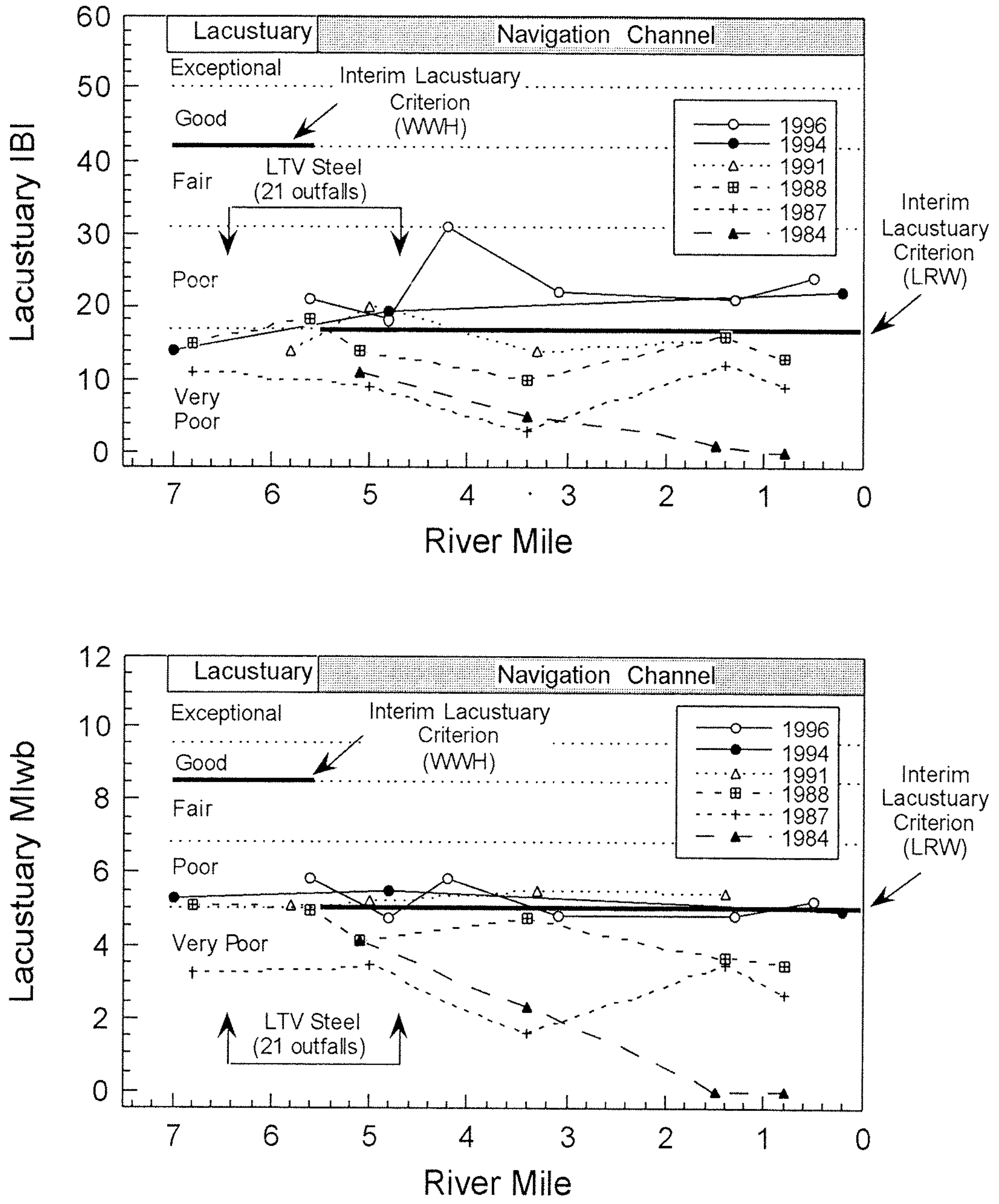


Figure 31. Fish community trends in the Cuyahoga River lacustuary and navigation channel (RMs 7.0-0.0), 1984-1996. Fish assemblages were evaluated using an interim set of IBI and MIwb criteria developed for Lake Erie river mouths (Ohio EPA 1999a,b Draft).

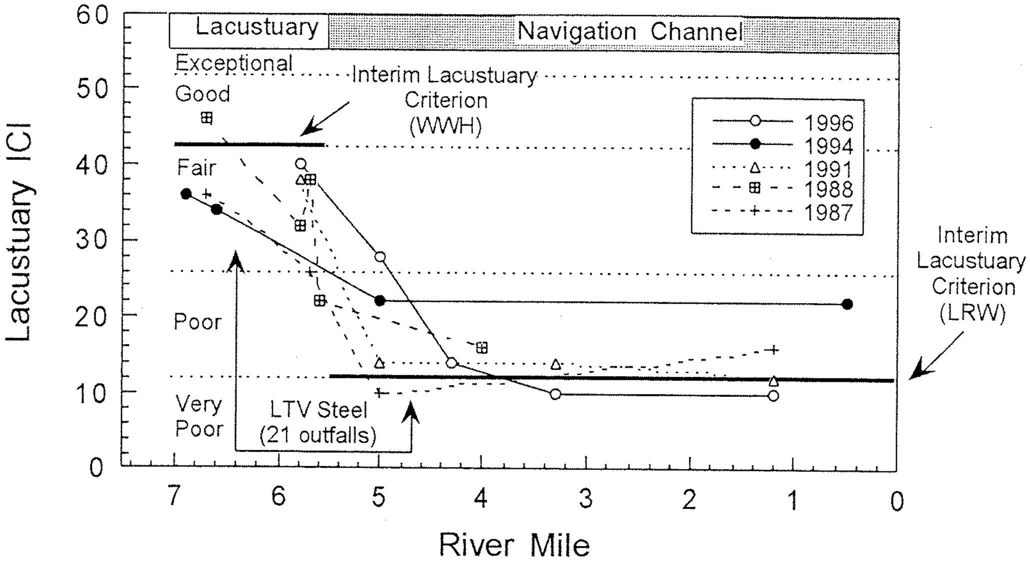


Figure 32. ICI trends in the Cuyahoga River lacustuary and navigation channel (RMs 7.0-0.0), 1987-97. Macroinvertebrates were evaluated using an interim set of criteria developed for Lake Erie river mouths (Ohio EPA 1999a,b Draft).

State of Ohio
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Division of Surface Water

Appendices to

Biological and Water Quality Study of the Cuyahoga River and Selected Tributaries

Volume 2

Geauga, Portage, Summit, and Cuyahoga Counties (Ohio)

August 15, 1999

P.O. Box 1049, Lazarus Government Center, 122 South Front Street, Columbus, Ohio 43266-1049

APPENDIX B

Physical Habitat Data

Appendix Table . Qualitative Habitat Evaluation Index (QHEI) matrix showing modified and warmwater habitat characterstics for fish sampling sites in the Cuyahoga River basin study area, 1996.

Key
QHEI
Components

			WWH Attributes											MWH Attributes																				
														High Influence						Moderate Influence														
River Mile	QHEI	Gradient (ft/mile)	No Channelization or Recovered	Boulder/Cobble/Gravel Substrates	Silt Free Substrates	Good/Excellent Substrates	Moderate/High Sinuosity	Extensive/Moderate Cover	Fast Current/Eddies	Low-Normal Overall Embeddedness	Max Depth > 40 cm	Low-Normal Riffle Embeddedness	**Total WWH Attributes**	Channelized or No Recovery	Silt/Muck Substrates	No Sinuosity	Sparse/No Cover	Max Depth < 40 cm (WD, HW)	**Total H.I. MWH Attributes**	Recovering Channel	Heavy/Moderate Silt Cover	Sand Substrates (Boat)	Hardpan Substrate Origin	Fair/Poor Development	Low Sinuosity	Only 1-2 Cover Types	Intermittent and Poor Pools	No Fast Current	High/Mod. Overall Embeddedness	High/Mod. Riffle Embeddedness	No Riffle	**Total M.I. MWH Attributes**	**(MWH H.I.+1)/(WWH+1) Ratio**	**(MWH M.I.+1)/(WWH+1) Ratio**
(19-001) Cuyahoga River																																		
Year: 96																																		
9.6	66.0	2.03	■			■	■	■	■	■	■	■	8				●		1		◆		◆						◆			3	0.22	0.56
8.3	67.0	2.03	■	■		■	■	■	■		■		7				●		1		◆								◆	◆		3	0.25	0.63
7.2	68.5	2.03	■			■	■	■	■	■	■		7				●		1		◆								◆	◆		3	0.25	0.63
5.6	41.5	0.10		■				■			■		3				●		1	◆	◆			◆	◆			◆	◆		◆	7	0.50	2.25
4.2	33.0	0.10									■		1	●			●		2		◆		◆	◆	◆	◆		◆	◆		◆	8	1.50	5.50
3.1	33.0	0.10									■		1	●			●		2		◆			◆	◆	◆		◆	◆		◆	7	1.50	5.00
1.3	40.0	0.10					■	■			■		3	●					1		◆			◆				◆	◆		◆	5	0.50	1.75
0.2	32.0	0.10									■		1	●			●		2		◆			◆	◆	◆		◆	◆		◆	7	1.50	5.00
(19-005) Big Creek																																		
Year: 96																																		
7.8	64.5	22.22	■	■		■	■	■		■	■		8				●		1		◆							◆		◆		3	0.22	0.56
3.1	50.5	41.67	■	■		■	■	■	■	■	■		9				●		2	◆				◆	◆					◆		4	0.30	0.70
0.2	53.0	12.50	■	■		■	■		■		■		6				●		1							◆			◆	◆		3	0.29	0.71
(19-006) Mill Creek																																		
Year: 96																																		
4.3	68.5	6.29	■	■		■	■	■		■	■		7				●		1					◆				◆	◆	◆		4	0.25	0.75
0.2	60.0	10.42	■			■	■	■	■		■		6				●		1		◆								◆	◆		3	0.29	0.71
(19-007) Tinkers Creek																																		
Year: 96																																		
0.2	70.5	9.43	■	■		■	■	■	■		■		7				●		1		◆								◆	◆		3	0.25	0.63
(19-009) Chippewa Creek																																		
Year: 96																																		
6.1	67.5	58.82	■	■		■	■	■			■		6			●			1		◆				◆			◆	◆	◆		5	0.29	1.00
3.8	43.0	33.33	■							■	■	■	4			●	●		2					◆	◆	◆		◆				4	0.60	1.40
0.3	68.5	20.93	■	■			■	■		■	■	■	7						0					◆				◆				2	0.13	0.38
(19-010) Brandywine Creek																																		
Year: 96																																		
7.0	56.0	5.88		■		■		■			■		4			●			1	◆	◆			◆	◆			◆	◆	◆		7	0.40	1.80
0.5	66.5	34.48	■	■		■	■	■	■	■	■		8						0		◆		◆							◆		3	0.11	0.44

APPENDIX C

Fish Sampling Data

Appendix Table . IBI metric scores from 1996 fish sampling sites in the Cuyahoga River lacustuary based on interim IBI scoring criteria (Ohio EPA 1999a,b Draft).

River Mile	Type	Date	Drainage area (sq mi)	Number of					Percent of Individuals						Rel.No. minus tolerants /(1.0 km)	IBI	Modified Iwb
				Total species	Centrarch. species	Sensitive species	Benthic species	Cyprinid species	Exotics	Tolerant fishes	Omni-vores	Top carnivores	Phyto-phils	DELT anomalies			
Cuyahoga River - (19-001)																	
Year: 1996																	
5.60	O	07/31/1996	788	15(3)	7(5)	1(1)	2(1)	4(3)	42(0)	66(0)	62(1)	10(1)	10.1(3)	20.6(0)	136(1) *	19	5.6
5.60	O	09/12/1996	788	11(3)	7(5)	0(0)	3(1)	0(0)	8(5)	22(5)	20(0)	22(1)	5.9(1)	15.2(0)	92(1)	22	6.0
4.80	O	07/31/1996	796	5(1)	2(1)	0(0)	1(1)	1(1)	17(3)	14(5)	7(1)	21(1)	2.2(1)	7.1(0)	28(1) *	16	4.9
4.80	O	09/12/1996	796	8(3)	3(1)	0(0)	2(1)	2(1)	3(5)	46(5)	27(0)	9(1)	0.9(1)	9.1(0)	22(1)	19	4.4
4.20	O	08/21/1996	796	10(3)	7(5)	1(1)	1(1)	2(1)	4(5)	28(5)	19(0)	7(1)	2.2(1)	2.3(3)	86(1)	27	5.1
4.20	O	09/24/1996	796	17(5)	9(5)	2(1)	4(3)	4(3)	10(3)	15(3)	8(5)	3(1)	6.1(1)	3.5(1)	564(3)	34	6.4
3.10	O	07/30/1996	805	3(1)	0(0)	0(0)	0(0)	2(1)	8(5)	40(5)	20(0)	0(0)	2.6(1)	0.0(5)	10(1) *	19	3.1
3.10	O	09/24/1996	805	4(1)	0(0)	1(1)	0(0)	1(1)	3(5)	0(5)	0(5)	2(1)	0.0(0)	0.0(5)	164(1) *	25	4.3
1.30	O	07/29/1996	807	6(1)	1(1)	0(0)	4(3)	0(0)	0(5)	60(1)	20(1)	0(0)	8.3(1)	0.0(5)	10(1) *	19	3.7
1.30	O	09/24/1996	807	12(3)	2(1)	2(1)	2(1)	5(5)	26(1)	21(3)	9(5)	7(1)	6.1(1)	6.8(0)	234(1)	23	5.9
0.50	O	08/21/1996	809	5(1)	1(1)	0(0)	1(1)	2(1)	19(1)	1(5)	1(1)	19(1)	4.6(1)	0.7(3)	288(1)	17	6.0
0.50	P	09/25/1996	809	5(1)	1(1)	1(1)	1(1)	1(1)	0(5)	1(5)	1(5)	1(1)	1.0(1)	0.0(5)	540(3)	30	4.3

♦ - IBI is low end adjusted.

Species List

River Code: **19-001** River Mile: **0.50**	Stream: **Cuyahoga River** Basin: Cuyahoga River Time Fished: 5733 sec Dist Fished: 1.00 km Drain Area: 809.0 sq mi No of Passes: 2	Sample Date: **1996** Date Range: 08/21/1996 Thru: 09/25/1996 Sampler Type: O P

Species Name / ODNR status	IBI Grp	Feed Guild	Breed Guild	Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
Gizzard Shad		O	M		233	233.00	36.01	0.26	2.82	1.10
Common Carp	G	O	M	T	3	3.00	0.46	4.40	48.62	1,466.67
Emerald Shiner	N	I	S		295	295.00	45.60	0.28	3.04	0.93
Spottail Shiner	N	I	M	P	1	1.00	0.15	0.00	0.02	2.00
Common Carp X Goldfish	G	O		T	2	2.00	0.31	2.50	27.62	1,250.00
Brook Silverside		I	M	M	1	1.00	0.15	0.00	0.02	2.00
White Bass	F	P	M		29	29.00	4.48	0.07	0.77	2.41
White Perch	E		M		64	64.00	9.89	0.24	2.64	3.74
Largemouth Bass	F	C	C		3	3.00	0.46	0.10	1.05	31.67
Pumpkinseed Sunfish	S	I	C	P	16	16.00	2.47	1.21	13.39	75.75
Mile Total					647	647.00		9.05		
Number of Species					9					
Number of Hybrids					1					

APPENDIX D

Macroinvertebrate Sampling Data

Appendix D. ICI metric scores from macroinvertebrate sampling sites (quantitative) in the Cuyahoga River lacustuary (RM 7.0-0.0), 1996.

		Number of			Percent:								
River Mile	Percent Lacustuary	Total Taxa	Sensitive Taxa	Dipteran Taxa	Mayflies & Caddisflies	Gatherers[a]	Sensitive Organisms	Other Diptera[b]	Predom Taxon	Diptera/ft^2	Qual. EPT	Eco-region	LICI
Cuyahoga River (19-001)													
Year: 1996													
5.80 E	82.9	38(6)	11(4)	18(4)	3.1(2)	48.4(6)	4.1(2)	82.0(2)	36.0(6)	276(4)	1(2)	3	38
5.00 W	71.4	24(4)	0(0)	17(4)	0.1(2)	73.0(4)	0.0(0)	89.1(2)	43.5(4)	99.0(6)	1(2)	3	28
4.30 E	61.4	14(2)	0(0)	7(2)	0.0(0)	97.1(0)	0.0(0)	99.8(0)	54.0(4)	145(6)	0(0)	3	14
3.30 E	47.1	15(2)	0(0)	6(0)	0.0(0)	99.5(0)	0.0(0)	99.9(0)	48.2(4)	248(4)	0(0)	3	10
1.20 W	17.1	20(2)	0(0)	5(0)	0.0(0)	94.8(0)	0.0(0)	99.7(0)	51.2(4)	213(4)	0(0)	3	10

---

[a] Percent of total gatherers as individuals excluding zebra mussels *(Dreissena polymorpha).*

[b] Percent of dipterans as individuals excluding the midge tribe Tanytarsini.

Ohio EPA/DSW Monitoring and Assessment Section
Macroinvertebrate Collection

Collection Date: 08/20/1996 River Code: 19-001 River: Cuyahoga River RM: 1.20 W

Taxa Code	Taxa	Quant/Qual	Taxa Code	Taxa	Quant/Qual
01320	*Hydra sp*	57			
01801	*Turbellaria*	324 +			
03600	*Oligochaeta*	1696 +			
04664	*Helobdella stagnalis*	15			
04666	*Helobdella triserialis*	1			
04935	*Erpobdella punctata punctata*	+			
04964	*Mooreobdella microstoma*	+			
05800	*Caecidotea sp*	68 +			
06201	*Hyalella azteca*	40 +			
06700	*Crangonyx sp*	29			
06810	*Gammarus fasciatus*	1 +			
22001	*Coenagrionidae*	1 +			
22300	*Argia sp*	10			
78650	*Procladius sp*	10			
82820	*Cryptochironomus sp*	+			
83051	*Dicrotendipes simpsoni*	1014 +			
83300	*Glyptotendipes (G.) sp*	20			
84000	*Parachironomus sp*	10			
84470	*Polypedilum (P.) illinoense*	+			
84540	*Polypedilum (Tripodura) scalaenum group*	10			
93025	*Bithynia tentaculata*	+			
95100	*Physella sp*	3 +			
96264	*Planorbella (Pierosoma) pilsbryi*	+			
96900	*Ferrissia sp*	1			
98200	*Pisidium sp*	1			
98600	*Sphaerium sp*	4 +			

No. Quantitative Taxa: 20 Total Taxa: 26

No. Qualitative Taxa: 15 ICI: **10**

Number of Organisms: 3315 Qual EPT: 0

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
6950 Americana Parkway, Suite H
Reynoldsburg, Ohio 43068-4132
(616) 469-6923/FAX (614) 469-6919

May 30, 2008

Lt. Colonel John S. Hurley
District Engineer
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, NY 14207

Attention: Environmental Coordinator, Patrice McKenna

Dear Colonel Hurley:

The U.S. Fish and Wildlife Service respectfully submits this Evaluation of CDF Plan 5 for inclusion in a Revised Section of our Draft Fish and Wildlife Coordination Act Report for the Dredged Material Management Plan for Cleveland Harbor, Cuyahoga County, Ohio. This revision has been prepared by the Service, in coordination with the Ohio Department of Natural Resources, Division of Wildlife, and provides information on the fish and wildlife resources in the project vicinity and an assessment of the potential environmental impacts on those resources from implementation of the proposed project (CDF Plan 5). In addition, this Revised Section recommends measures that should be taken to avoid, minimize, and compensate impacts to these important resources

This Revised Section does **not** constitute Section 7 consultation under the Endangered Species Act of 1973, as amended. The Corps must still submit to the Service a written determination of impacts on the piping plover critical habitat. In 2006, this office provided your staff with information regarding the Federally-listed species for the project vicinity.

This document has been prepared under the authority of the Fish and wildfire Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), the Endangered Species Act of 1973, as amended, and is consistent with the intent of the National Environmental Policy Act of 1969 and the U.S. Fish and Wildlife Service's Mitigation Policy.

If you have questions, or if we may be of further assistance in this matter, please contact me at extension 12 of this office.

Sincerely,

Mary Knapp

Mary Knapp, Ph.D.
Supervisor

Enclosures

cc: Ohio DNR. Division of Wildlife, SCEA Unit, Columbus, OH
Ohio EPA, 401/Wetland Section, Attn: Randy Bournique, Columbus, OH
USEPA, Office of Environmental Review, Chicago, IL

Ohio Department of Natural Resources

TED STRICKLAND, GOVERNOR
SEAN D. LOGAN, DIRECTOR

Division of Wildlife
David M. Graham, Chief
2045 Morse Rd., Bldg. G
Columbus, OH 43229-6693
Phone: (614) 265-6300

May 28, 2008

RECEIVED
JUN 02 2008
ES Reynoldsburg
FWS DOI

Dr. Mary Knapp, Supervisor
U.S. Fish and Wildlife Service
Ecological Services
6950 Americana Parkway, Suite H
Reynoldsburg, Ohio 43068-4127

RE: Evaluation of new CDF Plan 5
Dredged Material Management Plan for Cleveland Harbor
Cuyahoga County

Dear Dr. Knapp:

The Ohio Department of Natural Resources, Division of Wildlife (DOW) has received a copy of the "Evaluation of new CDF Plan 5 for inclusion in a Revised Section of DRAFT Fish and Wildlife Coordination Act Report, Section 2(b), Dredging Material Management Plan for Cleveland Harbor, Cleveland, Cuyahoga County, Ohio." After reviewing the report the DOW submits this letter to state our concurrence with the recommendations described in the report.

If you have any questions, please contact Becky Jenkins at (614)265-6631.

Sincerely,

JOHN NAVARRO
Program Administrator

JN/BJ/al

Evaluation of new CDF Plan 5
For inclusion in a Revised Section of DRAFT Fish and Wildlife Coordination Act Report, Section 2(b), Dredged Material Management Plan for Cleveland Harbor, Cleveland, Cuyahoga County, Ohio

Prepared for:
U.S. Army Corps of Engineers
Buffalo District
Buffalo, NY

Prepared by:
Department of the Interior
U.S. Fish and Wildlife Service
Reynoldsburg Ohio Field Office
Reynoldsburg, Ohio

May 2008

B. Alternative Plans under Development (refer to page 14 in April 2007 report)

PREFERRED ALTERNATIVE PLAN

In February 2008, the Service received the following information from the Corps of Engineers regarding a new alternative and requested that the Service assess this alternative in an amendment to the Service's April 2007 draft Fish and Wildlife Coordination Act report for the DMMP at Cleveland Harbor.

Alternative Plan 5

Alternative Plan 5, hereinafter "East 55th Street" would involve the construction of a single Confined Disposal Facility (CDF), as illustrated on the attached diagram. The CDF is approximately 198 acres in size. To the south, the East 55th Street site is bounded by the natural shoreline from the entrance of the State Park Marina extending roughly northeastward to the intake for the First Energy power plant's circulating water system. The west, north, and east boundaries would be formed by the proposed construction of a perimeter wall/dike. A portion of the eastern boundary would be formed by the existing First Energy circulating water intake (necessary improvements would be made to the structure). The perimeter walls would be rubble mound (similar in construction to the existing Dike 10B), sheet-steel pile cofferdams, or a combination of both. The CDF would likely be constructed in optimally-sized cells in order to spread out construction costs over time, while still maintaining cost-effectiveness. Cell size and sequencing has not yet been determined, but the combined footprint would not exceed what is shown in the following sketch. The anticipated volume would be in excess of 7 million cubic yards, which would provide approximately 20 years of capacity, assuming an annual dredging volume of about 330,000 cubic yards per year.

Note: Utility locations and proposed transportation infrastructure shown is for planning purposes only and should not be considered in this evaluation.

C. Impacts of Alternatives on Fish and Wildlife Resources

NEW CDF SITE EVALUATION

Although we have not seen figures for size of past proposed CDF's at Cleveland Harbor, it appears that the proposed East 55th Street Marina site would be the largest at approximately 200 acres. Because of its size and issues involving the marina, circulation of water in the Harbor, airport activities impacting many avian species, and impacts to the power plant intake/outfall, fishing access, and most importantly, the elimination of about 200 acres of aquatic habitat, this proposed site is controversial for many parties. We will explore many of these concerns in the following section.

The Service and Ohio DNR, among others, have serious concerns regarding the Corps' CDF proposal at the above marina. The CDF would significantly disrupt the circulation of harbor water in the area. This could result in water quality problems for the aquatic resources, as well as result in an accumulation of floating debris that would, at a minimum, be visually unappealing to the boaters, anglers, and local residents.

VI. FISH AND WILDLIFE CONSERVATION MEASURES

A. Discussion

The proposed East 55th Street Marina site presently provides excellent habitat for fishery resources, as well as water-related birds. For additional information about the fishery and wildlife resources, refer to the Service's April 2007 draft FWCA report for the DMMP for Cleveland Harbor, Cuyahoga County, Ohio. Also, a copy of Ohio DNR Division of Wildlife's report entitled *Ohio's Lake Erie Fisheries, 2007*, dated April 2008, can be viewed and/or downloaded at http://ohiodnr.com/Portals/9/pdf/eStatus2007.pdf. Also, since the April 2007 FWCA report, the bald eagle was delisted as a Federally-listed species. For your information we are including a copy of our latest guidance on *Bald Eagle Protection and Management.*

During our February 1, 2008 onsite review, we observed large flocks of gulls utilizing the water (some of it frozen) and land areas by the marina (Figure 1). Figure 2 shows the north dike of the marina; beyond the dike is a large area of open water that would be part of the CDF.

Figure 1. East 55th Street Marina, viewed from public access area.

Another development that we observed during our February 1 review was the fishing access features for shoreline anglers. Based on the amount of access features, we conclude that fishing pressure on this warm-water sport fishery is high, and success is good. This situation is indicative of the presence of good populations of supporting fish and invertebrate species, such as minnows and shiners, aquatic insects, and benthic organisms, such as crayfish, snails, and mussels.

This loss would also have to be mitigated with facilities in the vicinity. We surmise that these facilities are used by many Cleveland citizens who do not have resources to travel to other sites to fish from the shoreline.

Figure 2. East 55th Street Marina, north dike.

Figure 3. First Energy Power Plant east of Marina. Intake structure is located east of the dike in front of the power plant.

Of particular concern is the proposal's impact on the existing marina. Much of the boating from this facility is for sport fishing trips in the Cleveland Harbor area, as well as the central basin of Lake Erie. We support Ohio DNR's position that this loss must be compensated with the establishment of another marina in the area. At this time we are not aware of any plans to reestablish this facility.

To maintain a viable commercial shipping industry in Cleveland, we understand that a maintenance dredging program must continue. Without it, areas of the Cleveland Harbor and navigation channel of the Cuyahoga River would become too shallow for ships to pass safely.

In an effort to minimize the need to construct new CDF's in the harbor area, the Corps of Engineers addressed several measures to mitigate this need. These measures include beneficial uses of dredged material, management of existing CDF's to extend their lives, and the use of Best Management Practices (BMP's) in the watershed to reduce the volume of material required for dredging. We believe it is imperative that the Corps directly, or through its influence, maximize the use of these measures before initiating the construction a new CDF. It appears that modification of existing CDF's to accommodate more spoil material will be a necessity, due to immediate need. Fully implementing BMP's in the watershed would be dependent on national and local funding of many conservation projects that provide erosion reduction benefits.

There has been discussion in Corps documents about final use of filled CDF's. One site would be used by the Airport Authority for its activities. We understand that Plan 5 would be used by the Airport Authority. Therefore, wetland habitat development would not be possible, and fish and wildlife resources would be totally lost on this new land managed by the Airport Authority.

As always, maintenance dredging activities should be timed to minimize impacts to fish during the spawning period. The Ohio DNR, Division of Wildlife should be consulted for information restricting activities which would be detrimental to spawning fish.

Similar to implementation of BMP's in the watershed to reduce soil erosion, BMP's should be fully implemented with the maintenance dredging activity.

In the past the Service has made recommendations that the Corps construct a fish spawning shelf along any new dikes associated with new CDF construction. This feature would serve as partial mitigation for the loss of fishery resources in the area proposed for CDF construction. This feature was described in the Service's April 2007 report. Please refer to the report for details of the fish spawning shelf.

The continued reduction of Lake Erie by small increments should be addressed in subsequent documents. As our population grows and more impacts occur to the lake habitat, eventually short-sighted solutions (usually the cheapest with a narrow-minded perspective) have to be replaced with long-term "permanent" solutions.

We have noted that the Federal Aviation Administration (FAA) usually acts to intervene with U.S. Fish and Wildlife Service developments, such as the establishment of a wildlife refuge, in the vicinity of airport facilities, while it rarely intervenes with airport developments in the vicinity, or adjacent to active wildlife habitat areas. If wildlife habitat developments cannot be authorized near airports, airport developments should not be authorized near existing wildlife habitats! The entire Burke Airport development occurred within heavily used waterfowl corridors of the lake. Now the airport proposes further expansion without FAA interference, except for lethal wildlife management. Subsequent Corps documents regarding Plan 5 should include the USDA Wildlife Services program at Burke Airport, including data on lethally removed wildlife species from existing and proposed airport developments.

B. List of Recommendations

1. Fully explore the possibilities of beneficial use of dredged material in the Cuyahoga River watershed area (regardless of alternative plan pursued). Implement the feasible beneficial uses, either from barged loaded with fresh dredged materials or from consolidated materials on CDF's.

2. Fully implement BMP's in the watershed to minimize the volume of eroded materials entering the Cleveland Harbor (regardless of alternative plan pursued).

3. Maximize utilization of existing CDF's to forestall the need for construction of a new facility.

4. Fully implement BMP's during maintenance dredging operations to minimize impacts to water quality in the harbor.

5. Fully implement BMP's during any possible construction activities to increase capacity at an existing CDF, or a new CDF.

6. Except for CDF's near the airport, we recommend that CDF's be managed for wildlife as mitigation during intervals of non-activity, if feasible, and after final filling of the CDF. Management efforts should be coordinated with Ohio DNR Division of Wildlife.

7. We recommend consultation with the Ohio DNR regarding seasonal restrictions of dredging activities to protect the fishery resource during the spawning period, in particular.

8. We recommend that our suggestion to construct fish spawning shelves along the outside of newly constructed CDF dikes be fully explored with Ohio DNR Division of Wildlife staff to determine need and feasibility. This feature would serve as partial mitigation for loss of fishery habitat in the Cleveland Harbor area.

9. The proposed CDF would destroy more than 200 acres of warm-water aquatic habitat. Not only is this is a significant loss of habitat, but we believe the Corps should assess the cumulative impact of this habitat loss. In addition to our recommended fish spawning shelves, we recommend shoreline fish habitat improvements be implemented in conjunction with Ohio DOT's Cleveland Urban Core Projects.

10. We recommend that new marina(s), ramps, fishing access and public green space of similar or better size and quality be constructed nearby to mitigate for the loss of these services and areas to those that frequent the areas for fishing, boating, wildlife watching, and recreating in downtown Cleveland. If this cannot be accommodated by selection and size of this proposed CDF site, then alternate CDF site(s) should be pursued.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
6950 Americana Parkway, Suite H
Reynoldsburg, Ohio 43068-4127
(614) 469-6923 / FAX (614) 469-6919

April 24, 2008

Bald Eagle Protection and Management

On August 8, 2007, the bald eagle was removed from the Federal list of threatened and endangered species. Even though they are delisted, bald eagles are still protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act (Eagle Act). These Acts require some measures to continue to prevent bald eagle "take" resulting from human activities. These measures are very similar to the measures in place when the bald eagle was protected under the Endangered Species Act (ESA).

The Eagle Act prohibits anyone from **“taking"** bald eagles. “Take” under the Eagle Act is defined as to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb. "Disturb" is the form of take that is most likely to occur and is the most ambiguous. Therefore, the U.S. Fish and Wildlife Service prepared National Bald Eagle Management Guidelines. These Guidelines not Federal regulations but are intended to provide information on how to avoid impacts to eagles for people who engage in recreation or land use. The guidelines are crafted to reflect the way that Federal and State managers interpret the Eagle Act and the Migratory Bird Treaty Act. The guidelines, for example, recommend buffers around nests when conducting activities that are likely to disturb bald eagles. These buffers are the same as those which were established while the bald eagle was protected under the ESA.

The three actions described below pertain to implementation of the Eagle Act.

1) The U.S. Fish and Wildlife Service finalized modifications to a regulatory definition of "disturb" under the Eagle Act:
http://www.fws.gov/migratorybirds/issues/BaldEagle/DefinitionofDisturb.pdf

2) The Service released the final National Bald Eagle Management Guidelines which provide guidance to the public on how to prevent impacts to bald eagles that could violate the Eagle Act.
http://www.fws.gov/migratorybirds/issues/BaldEagle/NationalBaldEagleManagementGuidelines.pdf

- For the Upper Midwest, follow this link for an easy to use website that steps you through the Bald Eagle Management Guidelines:
  http://www.fws.gov/midwest/eagle/guidelines/index.html

3) On June 5, 2007, the Service opened a 90-day public comment period on a proposal to create a permit program to authorize limited “take” of bald and golden eagles where the "take" is associated with, and not the purpose of, otherwise lawful activities. The comment period closed on September 4, 2007. http://www.fws.gov/midwest/eagle/baea_bgepa_pruleFR05june07.pdf

For additional information on the bald eagle, visit the Service’s regional website:
http://www.fws.gov/midwest/eagle/

Please contact the Reynoldsburg, Ohio Field Office at (614) 469-6923 with any questions or concerns.

APPENDIX J

DESIGN ANALYSIS

Cleveland Harbor
Draft DMMP/DEIS
Design Appendix

1. INTRODUCTION

The Cleveland Harbor Confined Disposal Facility (CDF) proposed under the selected plan in this document is the newest in a series of CDFs that have been constructed at Cleveland Harbor, Ohio (reference Figure 2.2) to contain sediments dredged from the Federal navigation project that are unsuitable for open-lake disposal. The construction of a new facility will enable dredging of the project to continue well into the future as the facilities presented in the preferred plans are sized to contain sediments for 20 to 21 years of dredging (based on the base plan rate of annual dredging established in Chapter 2). The CDF and the Cleveland Harbor Dredged Material Management Plan (DMMP) are being developed under the Operations and Maintenance Authority for the Federal navigation project at Cleveland, Ohio.

2. PURPOSE AND SCOPE OF THIS APPENDIX

The purpose of this appendix is to describe the CDF alternatives proposed under the DMMP and to present the preliminary design for the construction of the selected plan. Approval of the DMMP and its appendices will provide the basis for the preconstruction engineering and design of the project. This report is the preliminary design level report. It includes the following information: the project authority; a description of the Federal navigation project at Cleveland Harbor; summaries of the field investigations and design work; the preliminary cost estimates for the preferred plans; a summary of the environmental investigations; and the preliminary project construction schedule. Information on the formulation and environmental impacts of this project can be found in the main document.

3. PROJECT AUTHORIZATION AND LOCAL COOPERATION

The existing Federal navigation project at Cleveland, Ohio was authorized by the River and Harbor Acts of 1875, 1886, 1888, 1899, 1902, 1907 and 1910. The 1937 River and Harbor Act made the maintenance of the channels of the Cuyahoga and Old Rivers to a depth of 21 feet below Low Water Datum (LWD) a Federal responsibility. All subsequent legislation has made maintenance of all channels included in the Federal project at Cleveland Harbor a Federal responsibility. The selected plan is to be constructed under the Operations and Maintenance Authority of the original project contained in the River and Harbor Acts of 1946, 1958, 1960, and 1962. The construction of a new CDF is required for the continued main entrance of the existing project which is consistent with the original project authorizing documents. The construction of the CDF is cost-shared in accordance with Section 201 of the Water Resources Development Act of 1996. The Cleveland Cuyahoga Port Authority and the City of Cleveland has indicated their intent to be the non-Federal sponsors and as such, will be required to provide the following:

a. 25% of the initial cost of the *base-plan* facility for Commercial Navigation projects where authorized depths range from greater than 20 feet to 45 feet.

b. 100% of the cost of all lands, easements, rights-of-way and relocations (LERR).

c. An additional 10% of the total project cost after construction over a maximum 30-year period. The non-Federal costs of lands, easements, rights-of-way and relocations (other than utility relocations) needed for the project are credited against this extra 10% non-Federal costs.

d. Maintenance of the facility after completion of its use for disposal purposes in a manner satisfactory to the Secretary of the Army.

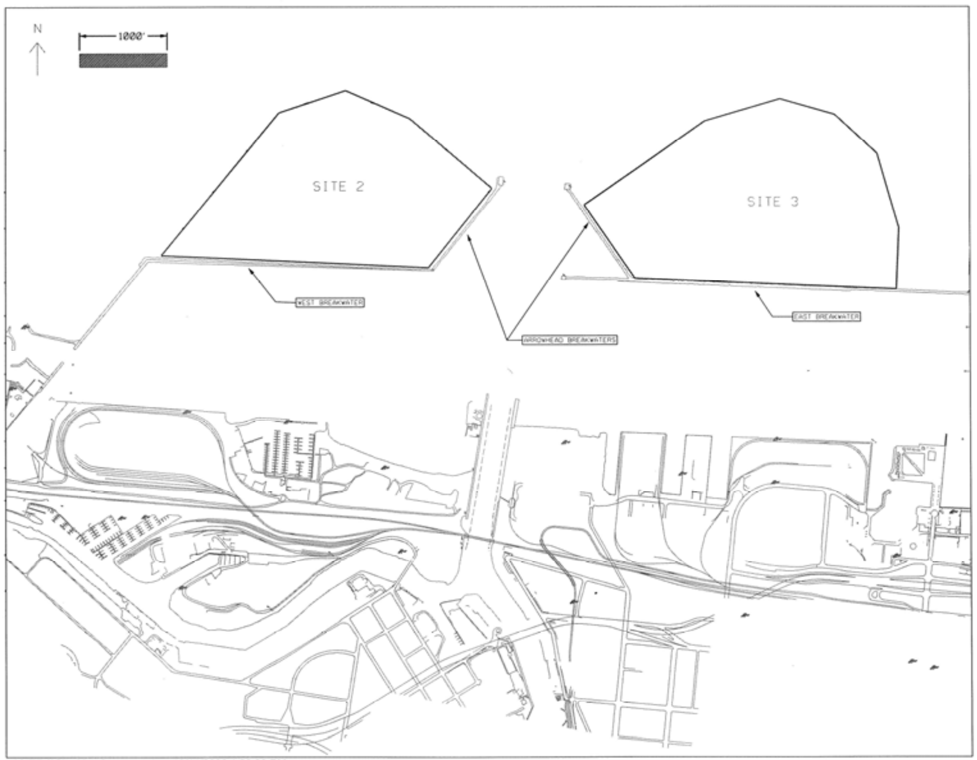
4. PROJECT DESCRIPTION

Preliminary CDF designs were developed to assess the feasibility of Sites 2, 2a, 3, 3a and East 55th Street as locations for a new CDF.

CDF Sites 2 and 3

CDFs at Sites 2 and 3 are both designed so that dredged fill can be placed up to +20' LWD. The CDF is esigned to contain sediments while allowing water to either evaporate or flow out of the disposal facility through the dike itself or through the overflow weir. Additional information regarding the sites is presented in Table 1. The proposed CDF locations are illustrated on Figure 1 below.

FIGURE 1 – Locations of proposed sites 2 and 3



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	SITE 2 CDF	SITE 3 CDF
AREA (ACRE)	108	117
EXISTING LAKEBED ELEVATION (FEET FROM LWD)	-20 to -30	-16 to -27
OPEN STORAGE VOLUME (CUBIC YARDS)	7.2 x 10^6	7.2 x 10^6

TABLE 1 – CDF information for Sites 2 and 3

A combination of steel sheet piling, geotextile filter, and granular filter are utilized within perimeter rubblemound structures to provide a barrier to contain dredged material. The rubblemound structures serve to support and protect the barrier materials. Stability berms are utilized at the toe of the rubblemound structures to ensure foundation stability. Typical rubblemound cross sections for Site 2 are illustrated on Figures 3 through 5. Typical rubblemound cross sections for Site 3 are illustrated on Figures 6 through 8. Table 2 includes a general description of the rubblemound materials illustrated on Figures 3 through 8.

MATERIAL	DESCRIPTION
A	5 to 10 ton stone
B	600 to 2000 lb. stone
C	0.5 to 12-inch stone, slag, or recycled concrete
D	1.5 to 4-inch stone, slag, or recycled concrete
E	3 to 12-inch stone or recycled concrete
F	0.1 to 0.75-inch stone/sand, slag, or recycled concrete
H	6 to 18-inch stone or recycled concrete

TABLE 2 – Rubblemound materials as illustrated on Figures 3 through 8

CDF Cells 1 and 2 of Alternative Plan 2a

Alternative Plan 2a involves constructing a in-harbor CDF cell (hereinafter “Cell 1”) in addition and prior to construction of a CDF cell (hereinafter “Cell 2”) in the outside the harbor at the location of Site 2. The intent of first constructing a cell inside the harbor is to provide capacity sooner and at a lower cost per cubic foot than that which can be provided by the open-water CDFs.

Alternative Plan 2a would involve the construction of a two celled CDF as illustrated in Tab C, this appendix. Cell 1, to be constructed and available for disposal of dredged material in 2015, would be approximately 65 acres in size and would have a top of wall elevation of +10 LWD. Construction of cell 1 would include the existing wall of the West Breakwater as the northern perimeter. To the east and south, Cell 1 would be constructed of new perimeter walls, consisting of vertical steel sheet pile walls. Cell 1 would be subdivided as necessary to improve the operational aspects of dredged material disposal. Cell 1 would be designed to have a life of about eight years assuming the average annual disposal of about 338,220 CY (about 2,620,000 CY total). Cell 1 would be operational from 2015 through 2022. Upon filling Cell 1 the area would be transferred to the non-Federal sponsor.

Cell 2 of Alternative Plan 2a would be constructed within the bounds of Site 2 and would include the West Breakwater as the southerly wall and would be operational from 2023 through 2035. It would be designed to have an area of 65 acres, a top of wall elevation of +20 LWD and an estimated capacity of 4,490,000 CY for a life of thirteen years at 338,220 CY per year. The north and west walls of Cell 2 would have a preliminary design identical to that of the Site 2 CDF.

CDF Cells 1 and 2 of Alternative Plan 3a

Alternative Plan 3a involves constructing a in-harbor CDF cell (hereinafter “Cell 1”) in addition and prior to construction of a CDF cell (hereinafter “Cell 2”) in the outside the harbor at the location of Site 3. The intent of first constructing a cell inside the harbor is to provide capacity sooner and at a lower cost per cubic foot than that which can be provided by the open-water CDFs.

Alternative Plan 3a would involve the construction of a two celled CDF as illustrated in Tab X, this appendix. Cell 1, to be constructed and available for disposal of dredged material in 2015, would be approximately 50 acres in size and would have a top of wall elevation of +10 LWD. Construction of cell 1 would include the existing wall of the East Breakwater as the northern perimeter. To the east and south, Cell 1 would be constructed of new perimeter walls, consisting of vertical steel sheet pile walls. Cell 1 would be subdivided as necessary to improve the operational aspects of dredged material disposal. Cell 1 would be designed to have a life of about five and a half years assuming the average annual disposal of about 338,220 CY (about 1,800,000 CY total). Cell 1 would be operational from 2015 through 2020. Upon filling Cell 1 the area would be transferred to the non-Federal sponsor.

Cell 3 of Alternative Plan 3a would be constructed within the bounds of Site 3 and would include the West Breakwater as the southerly wall and would be operational from 2020 through 2034. It would be designed to have an area of 79 acres, a top of wall elevation of +20 LWD and an estimated capacity of 4,650,000 CY for a life of fourteen years at 338,220 CY per year. The north and west walls of Cell 2 would have a preliminary design identical to that of the Site 3 CDF.

CDF Alternative Plan East 55th Street Site

This plan would involve the construction of a single Confined Disposal Facility as illustrated in Figure 2 below. The CDF is approximately 157 acres in size. To the south, the East 55th Street site will be bounded by an improved State Park Marina breakwater, the natural shoreline near the terminus of East 55th Street, and a to-be-constructed perimeter wall/dike. A portion of the eastern boundary would be formed by the existing First Energy circulating water intake (necessary improvements will be made to the structure) and the remainder of the perimeter shown will be formed by still to be constructed walls. The perimeter walls will be comprised of both rubblemound dikes (similar in construction to that of existing Dike 10B) and back-to-back open cell wall design. Since this site may be converted into a commercial port by the local sponsor, the local sponsor requests a vertical surface along the northern, eastern, and a portion of the western outer walls for mooring vessels.

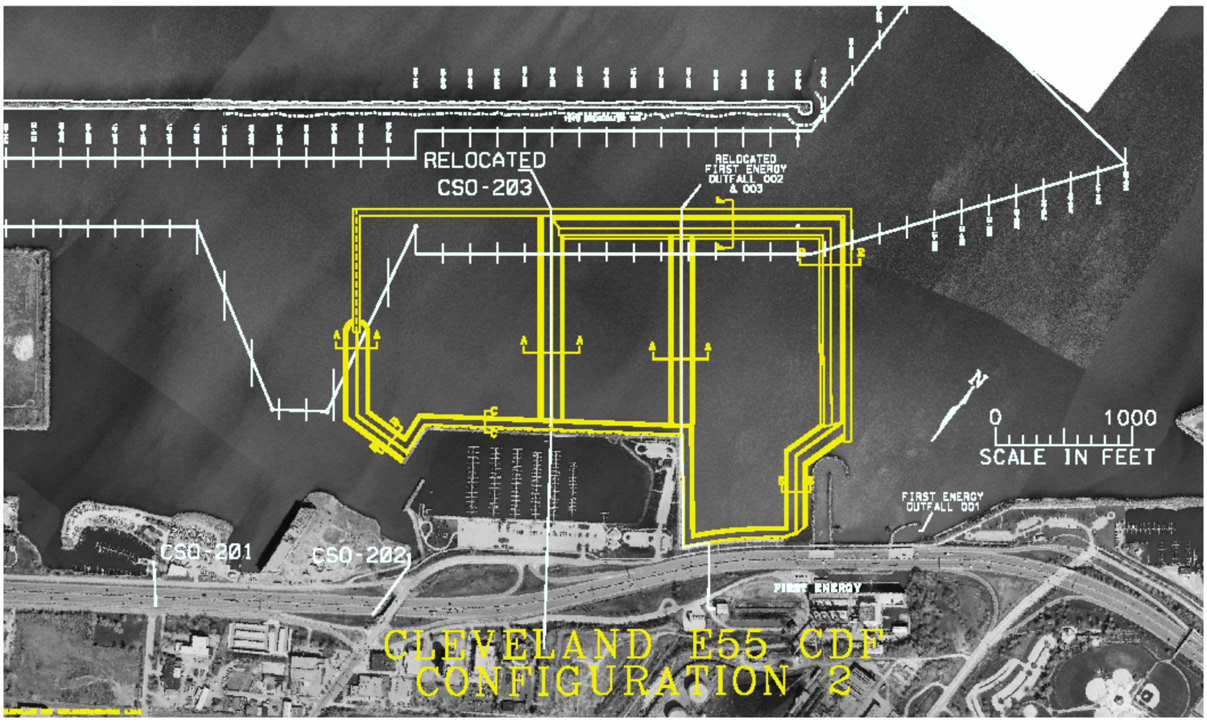

FIGURE 2 – East 55th Street CDF

The CDF would be constructed in optimally sized cells in order to spread out construction costs over time while balancing cost effectiveness. Cell size and sequencing has not yet been finalized, but the combined footprint will not exceed what is shown in the attached sketch. Anticipated volume is 6,850,000 cubic yards, which will provide approximately 20 years of capacity assuming an annual dredging volume of about 338,220 cubic yards per year. The first cell would be constructed from 2012 through 2014, allowing filling operations to begin in FY15. Additional cells would follow, with each subsequent cell becoming operational as the previous cell is filled.

5. SUBSUFACE AND GEOTECHNICAL INVESTIGATIONS

Geotechnical field investigations were not conducted in direct support of the preliminary design analysis. Soundings for used in preparation of the preliminary designs were taken from project condition surveys conducted in 2007 by survey personnel from the U.S. Army Corps of Engineers, Buffalo District and published National Oceanic and Atmospheric Administration nautical charts. A bathymetric survey was conducted within the footprint of the East 55th Street site in

Subsurface investigations in support of preconstruction engineering and design are planned for Fiscal Year 09. Design assumptions are based on historical data for marine construction in the harbor and engineering judgment. A summary of subsurface design criteria is discussed in Paragraph 8, this appendix.

6. DESIGN WAVE ANALYSIS

A design wave analysis at the proposed CDF sites was not completed, however past investigations have suggested an incident significant design wave along the East Breakwater of approximately 13 feet. Dike 10b within the interior of the harbor was designed based upon an incident significant design wave of 6 feet. Typical stone sizes, armor slopes, cross-section configurations and crest elevations were selected based upon East Breakwater repair experience, and past CDF designs which had crest elevations based upon limiting wave overtopping. A rigorous wave analysis will be required during the detailed design of the selected alternative.

7. DESIGN CROSS SECTION

Construction of a deep water facility presents many challenges. Perimeter walls must accommodate wave heights up to 13 feet. The three preferred alternative CDF designs are Site 2, located along and lakeward of the West Breakwater, Site 2a, located lakeward and landward of the West Breakwater, Site 3, located along and lakeward of the western end of the East Breakwater (Figures 2.7 through 2.9). The primary differences between CDFs 2 and 3 include area, water depth, and capacity; CDF 2 is somewhat smaller in area (108 acres) than CDF 3 (129 acres). However, the water depth for CDF 2 is approximately four feet greater than for CDF 3.

Sites 2 and 3

A combination of steel sheet piling, geotextile filter, and granular filter are utilized within perimeter rubblemound structures to provide a barrier to contain dredged material. The rubblemound structures serve to support and protect the barrier materials. Stability berms are utilized at the toe of the rubblemound structures to ensure foundation stability. Typical rubblemound cross sections for Site 2 are illustrated on Figures 3 through 5. Typical rubblemound cross sections for Site 3 are illustrated on Figures 6 through 8. Table 2 includes a general description of the rubblemound materials illustrated on Figures 3 through 8.

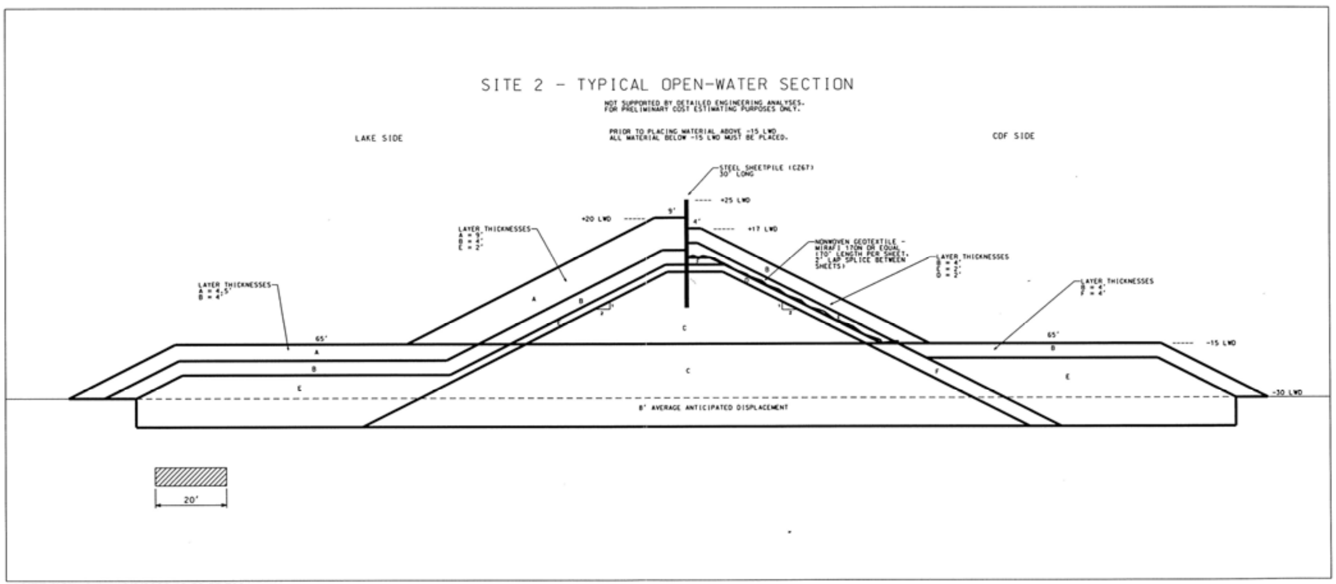

Figure 3 - Site 2 Typical Cross Section in Open Water

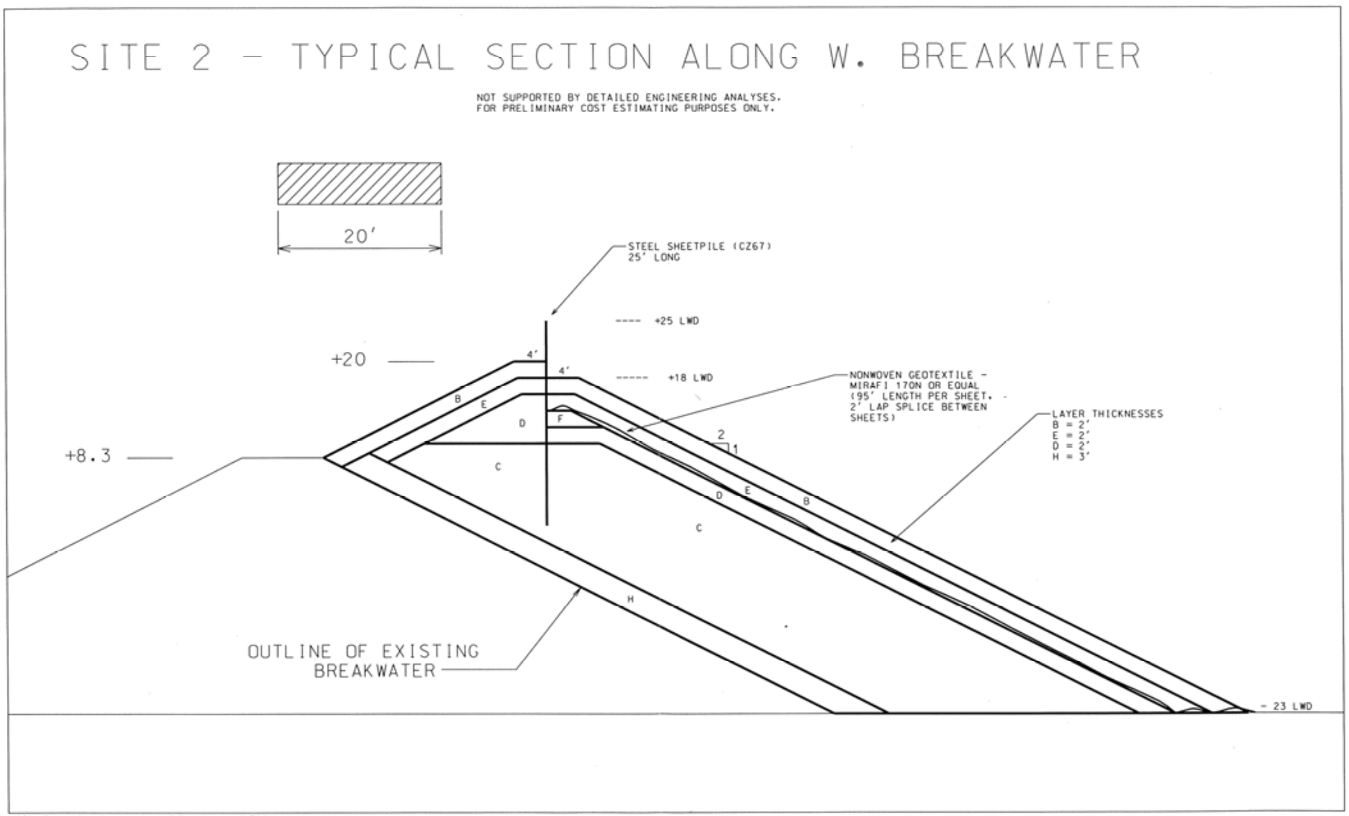

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Figure 4 - Site 2 Typical Cross Section Along W. Breakwater

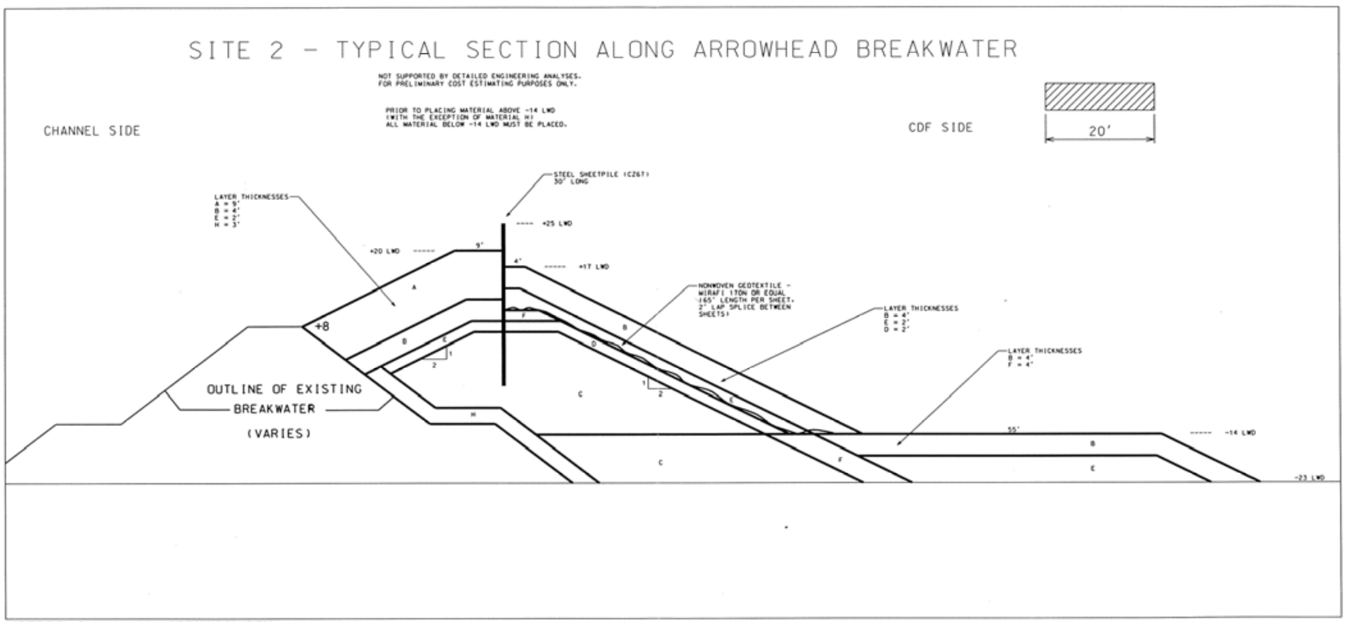

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Figure 5 - Site 2 Typical Cross Section Along Arrowhead Breakwater

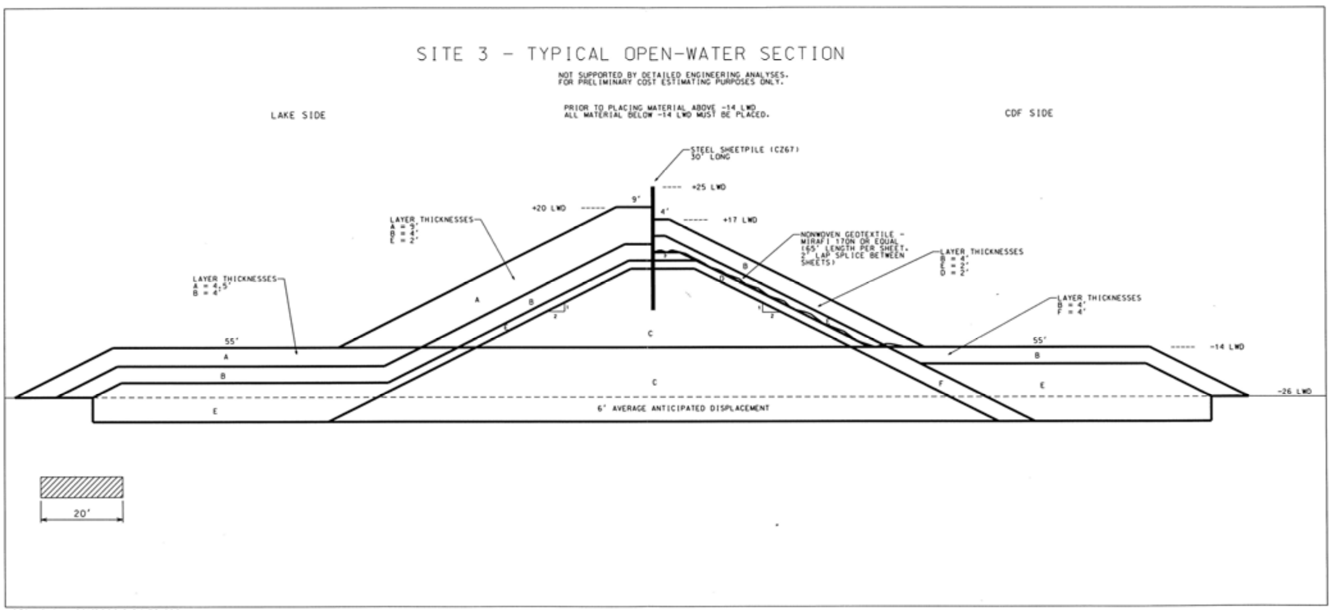

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Figure 6 - Site 3 Typical Cross Section in Open Water

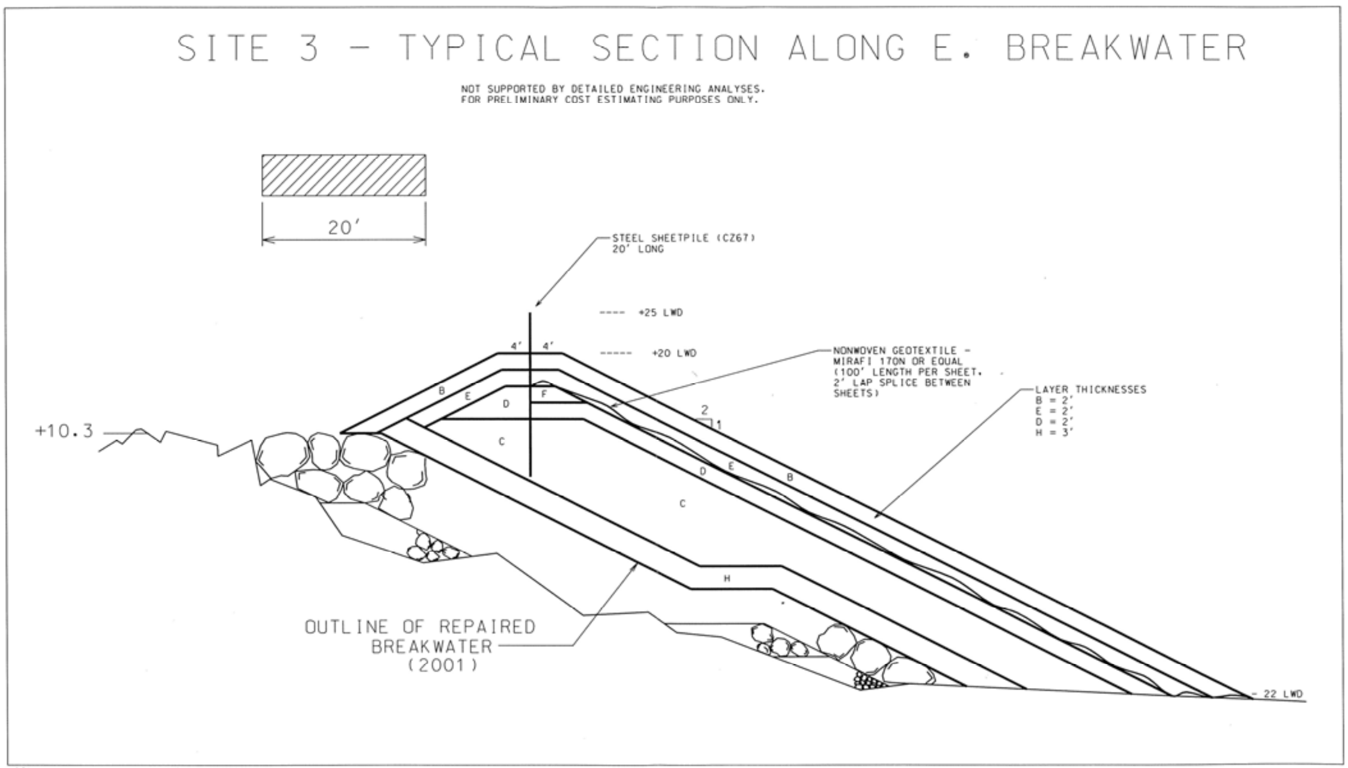

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Figure 7 - Site 3 Typical Cross Section Along E. Breakwater

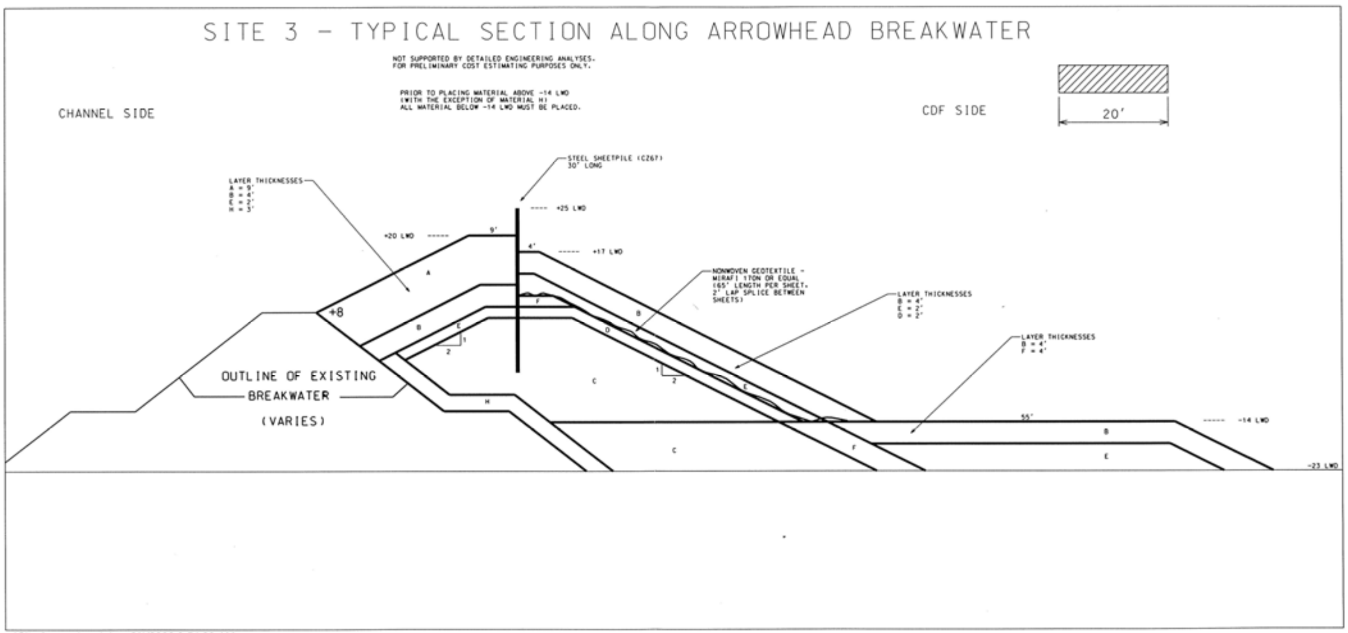

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Figure 8 - Site 3 Typical Cross Section Along Arrowhead Breakwater

The cross section is made up primarily of bedding stone and a filter layer. The filter layer is designed to retain sediments while allowing water to pass through the dike. Water will typically flow out of the dike during and for sometime after annual dredging operations or during prolonged periods of precipitation. Water may also flow into the diked area when water levels fluctuate on Lake Erie. A geotextile fabric will be placed over the filter layer to keep the material in this layer from migrating through the underlayer and being washed out. The dike as designed is high enough to limit wave overtopping which could bring water into the containment area.

On the disposal area side of the dike the bedding and filter layers will be covered by two layers of underlayer stone which will be large enough to protect the dike slope from the limited wave activity that can be expected in the enclosure. The harbor side of the dike will also have the two layers of underlayer stone with an additional layer of armor stone to protect against the wave climate that can be expected in the harbor area. Geotechnical studies concluded that a wide berm at the base is required on either side of the dike to provide for structural stability. Note that there is considerable displacement of the existing very soft bottom materials with the bedding stone. It is estimated that between 7 to 9 feet of displacement in the bottom sediments will take place, with the bedding stone providing the foundation base for the dike.

Cell 1 of Alternatives 2a and 3a

The design cross-section for Cell 1 of Alternatives 2a and 3a is a vertical walled dike comprised of a sheet steel pile and combi-wall system as shown in Figure 9. The intent of the vertical walled cell is to reduce the footprint of the cell and its corresponding encroachment on the existing Federal channel. Inside the cell, the vertical walls maximize available disposal capacity in what is a relatively small disposal space. The vertical walls also leave open the possibility that the cell could be used as future port facilities, if the local sponsor so chooses. This design is only suitable for cells inside the protected harbor, as they are not able to withstand the wave and ice action of the open lake water.

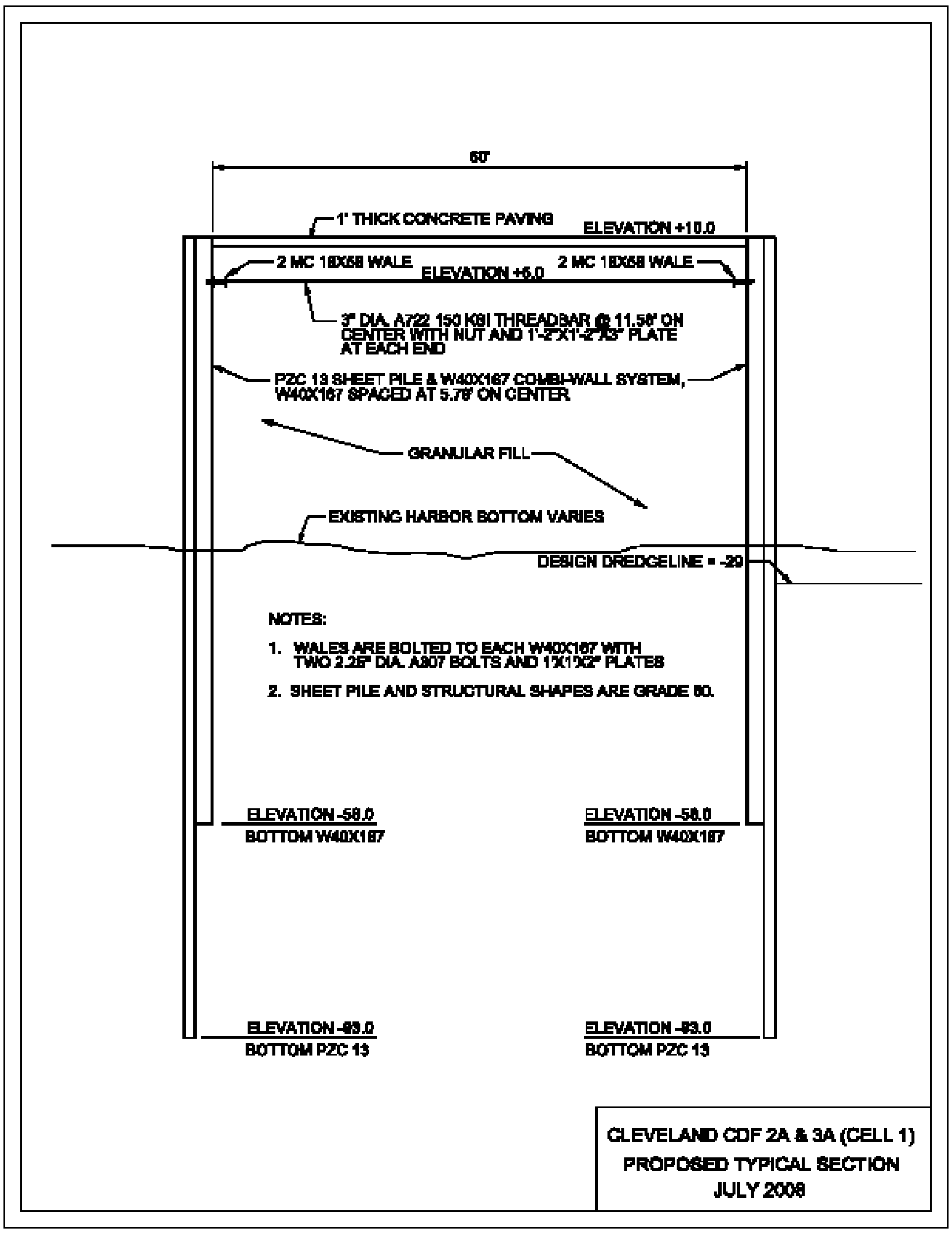


Figure 9: Cleveland CDF Alternative 2a and 3a Typical Section

Cell 2 of Alternatives 2a and 3a

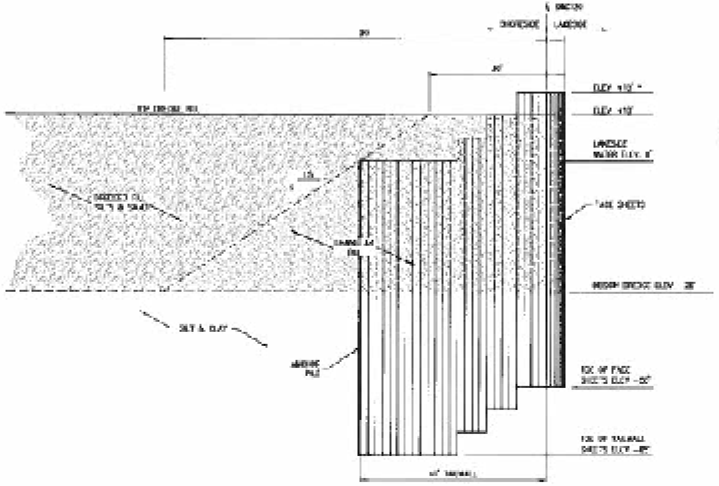
Cell 2 of Alternative 2a is sited within the bounds of Site 2, but has a reduced footprint due to its reduction of capacity in an amount equal to the volume provided by Cell 1. As described in Paragraph 4 above, Cell 2 would provide the remaining 13 years of the 21 years of capacity Alternative 2a provides. Cross sections are similar to those presented for Site 2. Preliminary design information for Cell 2 Alternative 2a is shown in Tab C.

Cell 2 of Alternative 3a is sited within the bounds of Site 3, but has a reduced footprint due to its reduction of capacity in an amount equal to the volume provided by Cell 1. As described in Paragraph 4 above, Cell 2 would provide the remaining 14 years of the 20 years of capacity Alternative 3a provides. Cross sections are similar to those presented for Site 3. Preliminary design information for Cell 2 Alternative 3a is shown in Tab D.

East 55 Street Site Alternative

For the rubblemound portions of the East 55th Street site, typical stone cross-sections for the existing CDF at Dike 10b and the proposed Site 2 were assumed applicable to this site. It is assumed the phased construction would progress east to west. The plan and typical cross-sections are presented in Tab E of this appendix.

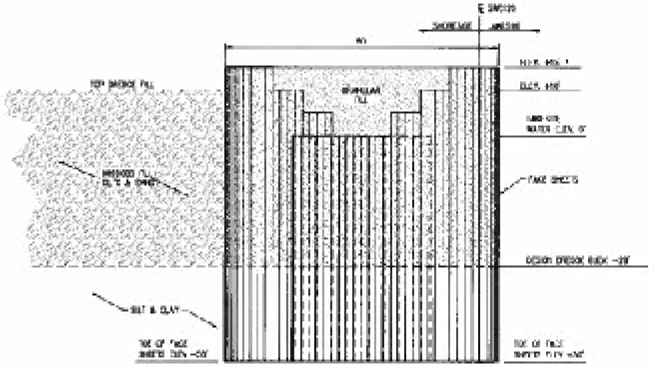
The design for vertical walled portions of the East 55th Street Alternative was developed by PND Associates, a consultant to steel supplier LB Foster, in cooperation with USACE. When USACE contacted LB Foster for cost quotes in support of cost estimating efforts, LB Foster stated that they had been in contact with other consultants involved in the potential port relocation project and that they had identified other designs that may be more cost effective. USACE originally designed a combi-wall system; LB Foster and PND Associates recommended a back-to-back open cell design. Further discussion and a review of the proposed design indicated that the design was acceptable for dredged material disposal and resulted in less steel tonnages and sheet pile members that are more readily available and easier to produce. The back-to-back open cell design is used in the cost estimate of the preliminary Federal Standard design for the site and is shown in Figure 10 below (the Federal standard means the dredged material disposal alternative or alternatives identified by the Corps which represent the least costly alternatives consistent with sound engineering practices and meeting the environmental standards). However, further analysis by the Port Authority and its consultant determined that the design is not suitable for the surcharges the relocated port facilities will add. Therefore, the combi-wall system, similar to what is used in the preliminary designs for Cell 1 of Alternatives 2a and 3a, is used as the locally preferred design for the East 55th Street site in Tab E of this appendix.



SECTION A-A
SINGLE OPEN CELL® WALL

1) +1' WALL HEIGHT TO ALLOW FOR SETTLEMENT. FUTURE CUT-OFF TO ELEV. +10'
2) CONCRETE CAP MAY BE ADDED AS DESIRED
3) GRANULAR FILL REQUIRED, SIMILAR OR LESS THAN DOUBLE WALL SYSTEM.
4) MAXIMUM SHEET PILE LENGTH 65'

MATERIAL QUANTITIES-SINGLE WALL SYSTEM			
PILE TYPE	PILE LENGTH	QUANTITY	TONNAGE
SINGLE WYE PILE	67'	[illegible]	[illegible]
ANCHOR PILE	65'	[illegible]	[illegible]
PS27.5 FLAT SHEET	[illegible]	[illegible]	[illegible]
TOTAL	—	—	[illegible]



SECTION B-B
BACK-TO-BACK OPEN CELL® WALL

1) +1' WALL HEIGHT TO ALLOW FOR SETTLEMENT. FUTURE CUT-OFF TO ELEV. +10'
2) CONCRETE CAP MAY BE ADDED AS DESIRED
4) MAXIMUM WALL PILE LENGTH 65'

MATERIAL QUANTITIES-DOUBLE WALL SYSTEM			
PILE TYPE	PILE LENGTH	QUANTITY	TONNAGE
SINGLE WYE PILE	67'	[illegible]	[illegible]
ANCHOR PILE	[illegible]	[illegible]	[illegible]
ANCHOR PILE	67'	4	[illegible]
PS27.5 FLAT SHEET	67'	[illegible]	[illegible]
PS27.5 FLAT SHEET	[illegible]	[illegible]	[illegible]
PS27.5 FLAT SHEET	[illegible]	[illegible]	[illegible]
PS27.5 FLAT SHEET	[illegible]	[illegible]	[illegible]
TOTAL			[illegible]

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OPEN CELL SYSTEM IS PATENTED
PATENT – US [illegible]
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REVISIONS		
NO.	DATE	DESCRIPTION

PROJECT:
CLEVELAND FIRST ENERGY
E55 STREET CDF PROJECT

TITLE:
TYPICAL SECTIONS

SHEET No.
3 of 3

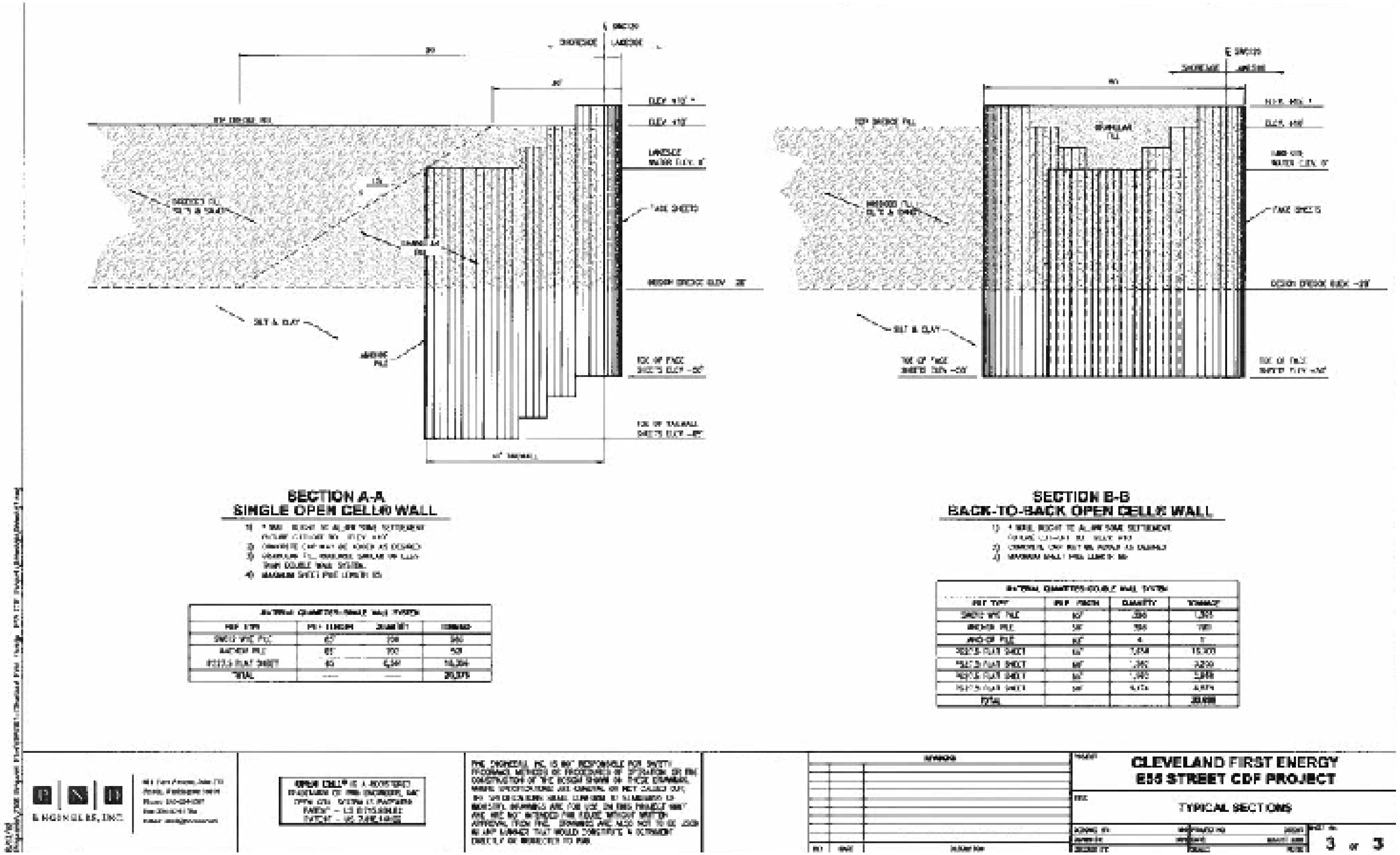

Figure 10 Back-to-Back Open Cell Design for East 55th Street Site (Federal Standard)

Alternate Dike Cross-Section Designs Considered

Due to the deep water, the size of the proposed open water CDFs, and the settle-ability of the lake bottom, the size of the cross section and thus, amount of stone required for construction is unprecedented along the lower Great Lakes. There is currently no single quarry on Lake Erie able to produce the size and quantity of stone required to construct the proposed Outer Harbor CDFs. Limitations on quantity and quality of stone required to construct CDFs in Cleveland Harbor are the primary cause of the high preliminary cost estimate. Available quarries would be required to increase production rates in order to meet construction demands by adding plant and personnel and opening new quarry space. Associated costs will be passed along to the Government through escalated unit costs. Thus, the engineering team pursued several alternative cross sections in an effort to reduce costs. These include:

Geosynthetic Containers - As an alternative to high cost stone revetments, geosynthetic containers are an innovative technique currently used to contain dredged material. Containers are prefabricated in a factory to form an elongated box with an open lid to meet the capacity needs of a given project and the configuration of the barge. The container is placed in the hopper of a split hopper barge. Dredged sediment is pumped into the container and once 75-80% full, the inlet of the container is sealed. The barge is towed to the disposal site, the container is released by opening the split hopper, and the container falls to the lakebed. For the purposes of this project, sediment dredged from the Federal channel could be placed directly into geosynthetic containers hydraulically as described above or could be mechanically filled with dredged material from existing CDFs and/or sediment directly pumped from the dredging operations. The containers would be transported and deposited in location where the perimeter dikes of the CDF would be constructed. Volume occupied by geosynthetic containers would reduce the volume of materials needed to construct the new CDF. Specifically, they could be used to supply the required volume and mass required in the stability berm or for interior berms to create sub-cells as necessary. Containers would be used as a base for construction of the perimeter footprint and interior berms to create sub cells as necessary.

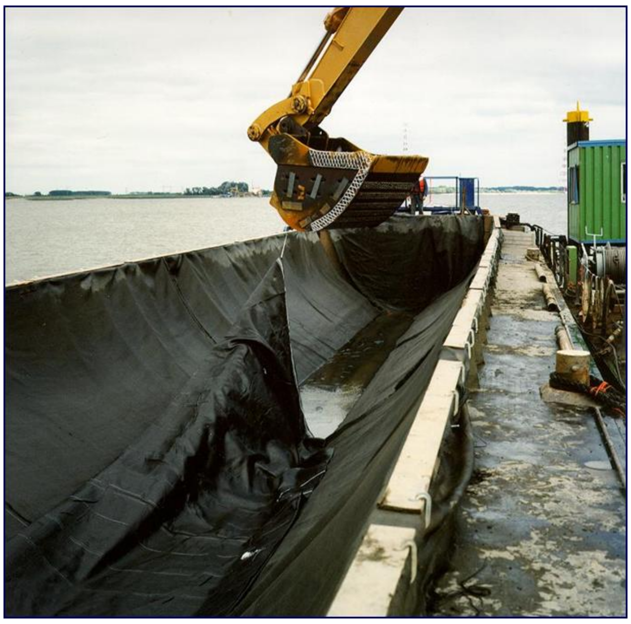

Figure 11 Geocontainer lining the barge. **Figure 12** Geocontainer filled with dredged sediment.

Figure 13 Closing filled Geocontainer. **Figure 14** Geocontainer sewn shut.

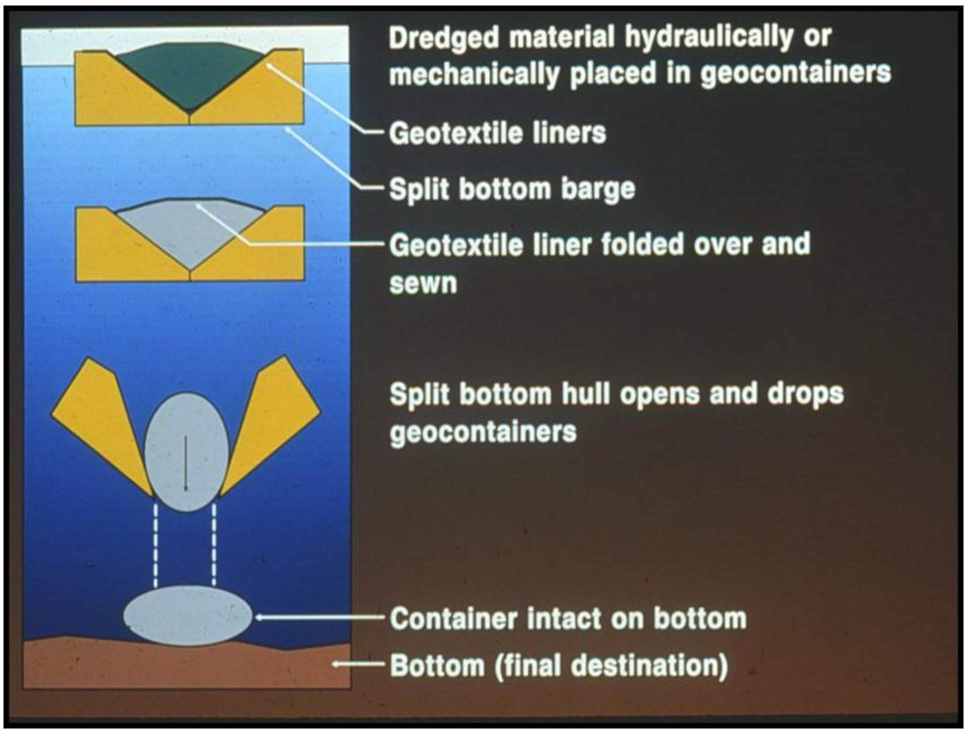

Figure 15 Geocontainer fill and disposal phases.

Using Site 2 as a case study, use of geocontainers in lieu of a portion of core stone (identified as stone type B, C, and E in the preliminary designs) reduces total stone quantities by 1,839,000 tons. Cost savings are estimated at approximately $20,000,000. However, due to the unproven and untested nature of the geocontainers as a core material in large, rubblemound dikes and potential regulatory concerns, further study is needed. Therefore, cost estimates for the purposes of plan formulation and analysis are based on virgin stone in all rubblemound dikes.

This value engineering alternative will be carried forward. Rubblemound dikes comprise at least a portion of the perimeter dikes of all CDF alternatives; should the alternative prove feasible and cost effective during detailed design, cost savings will be yielded no matter the alternative selected.

Prefabricated Caissons - Caissons are another innovative prefabricated construction alternative. Structures would be pre-fabricated and mobilized to the construction site and ballasted onto a previously prepared foundation. There are several types of caissons including open, box, and pneumatic. Open caissons are open at the top and bottom, box caissons are closed at the bottom, open at the top, and pneumatic caissons are airtight chambers to accommodate submerged workers. Of the three caisson alternatives, box caissons are typically used in underwater construction and as a foundation. The most likely alternative for CDF construction would be generally rectangular, pre-cast, modular, interlocking, buoyant concrete sections that are floated into position, ballasted with dredge material, steel slag, recycled concrete, or similar material, and post-tensioned. Box caissons can be rectangular or circular, and constructed to accommodate a range of sizes hundreds of feet in diameter (Encyclopedia Britannica, 2007).

Cost analysis was based on use of pre-cast concrete caissons as the core of the Site 2 CDF verses construction of a stone CDF by "traditional methods". Costs are for constructing large concrete caissons on land, floating to the construction site, placing by filling with water and then dredge material; each caisson to be approximately 120 feet long by 30 feet wide by either 22 or 26 feet in height. For the 4925 lf of full cross-section rubblemound dike in the Site 2 CDF there would be 41 larger units sitting on 82 smaller units. These units would be constructed on the lake front where they could easily be floated. Construction of each unit consists of form work, reinforcing steel and concrete placement. A stone bed would be constructed 4 feet thick with the smaller caissons being placed side by side on the bedding stone and the larger units sitting on top of the smaller stacked in a pyramid shape. After the placement of each caisson the interior of each caisson would be filled with dredge material. On the lake side, bedding, underlayer and armor stone would be placed against the units to protect the caissons from wave action. On the "fill" side a sand/stone filter layer would be placed against the caissons.

By contrast, for typical of CDF construction, different layers of stone would be layered to build a containment cell for dredge material. Different layers include core, filter, underlayer and armor stone material of various thicknesses. Construction would consist of placing core stone most likely by a self unloading ship followed by placing of the other various layers of other material by crane and barge. Due to the potential size of this project, pricing was obtained for the various materials. Cost Engineering started by estimating the costs for building the caisson units. Placement costs were to be developed next. Due the large costs of construction of the units on land (not placement), cost engineering looked at the construction of a rubblemound CDF that would occupy the same volume of space as the caissons would. Cost Engineering determined the cost of the construction of the caissons alone to be approximately $30 million versus the cost of construction of a stone core that occupies same volume of stone at approximately $23 million. Cost Engineering did not continue any further development of placement costs for the caisson alternative as this would only increase the cost of this alternative.

Therefore, this alternative is not carried forward to detailed design.

Vertical walls – Despite multiple design iterations and several conceptual ideas, the team was unable to identify a feasible vertical containment structure such as concrete sea walls or sheet steel pile for the CDF alternatives outside the protective breakwater system. The primary constraint is water depth and wave action. Vertical structures for open-water will not be carried further in design.

Pre-cast concrete armoring units – In support of efforts to identify alternative materials to quarried stone in the design cross-section, the design team also considered pre-cast concrete armoring for the rubble mound structures. However, research of prior bid prices and supplier quotes indicated unit prices higher than that of the virgin stone. However, given the previous discussion of the high cost of quarried armor stone and the inability of quarries to meet supply needs for this project, which increases cost, the precast concrete armor unit alternative will be revisited during detailed design and cost estimation to verify the economic validity of this alternative.

A comprehensive value engineering study will be conducted during detailed design and value engineering considerations will be at the forefront of all design efforts.

8. SUMMARY OF GEOTECHNICAL AND SUBSURFACE INFORMATION

The soil conditions at the project location are poor from a foundation design standpoint. The first approximately ten feet of bottom sediments is generally a very soft muck which is primarily silt with organic material. Beneath the muck is about 20 feet of medium to high plasticity soft to medium stiff clay and silty clay with silt lenses. Beneath these clays are stiffer materials which appear to be glacial till. The till deposits are semi-sorted and unstratified.

The objective of the dike stability analyses was to determine a dost-effective, stable dike configuration that would prevent shear failure of the underlying soil foundation. Analyses were performed for both the end of construction and long term conditions. In order to meet the required 1.3 factor of safety, it was determined that berm is required on both the containment and harbor sides of the dike. The factors of safety obtained are considered acceptable for this type of structure.

The objective of the dike settlement analyses was to determine if excessive foundation settlement would occur over time which could result in unacceptable loss of dike freeboard. The laboratory consolidation tests conducted on the soil samples indicate that these soils are pre-consolidated to some degree with overconsolidation ratios varying from 1.2 to 9.0. The analyses resulted in the conclusion that although settlement will occur, it will occur over a long period of time and the fill material will consolidate simultaneously, negating the need for any special construction procedures.

The long-term storage capacity of the containment area was determined by estimating the consolidation of the foundation soils and the sediments placed in the CDF. It was estimated that approximately 338,220 cubic yards of sediment will be removed annually at Cleveland Harbor. This quantity is based on historical annual dredge quantities and takes into account land use changes and other factors within the Cuyahoga River basin. The analyses conducted using the 338,220 cubic yards per year resulted in a storage capacity of between 20 to 21 years for the preferred CDF locations.

A summary geotechnical narrative for preliminary cellular wall design is in Tab G, this appendix.

9. STRUCTURAL DESIGN NARRATIVE

Preliminary structural design has been performed for the vertical wall system for the Cleveland Harbor Confined Disposal Facilitiy E55, 2A (Cell 1) and 3A (Cell 1) Sites by the Buffalo District Civil/Structural Design Team. The vertical wall system consists of parallel combi-walls (steel sheet pile and wide flange king piles) 60 feet apart anchored together near the top with double steel channel wales and threadbar tierods. The space between the vertical walls is filled with granular fill and capped with a temporary concrete slab as protection against loss of fill from wave overtopping. The vertical wall system initially functions as a containment structure as the CDF is being filled with dredged material. After the CDF is filled and turned over to the local sponsor, a new terminal port facility will be constructed at the CDF. The vertical walls would be used for the docking of cargo ships at the new terminal port facility. The structural design was performed in accordance with guidance found in engineering manual EM 1110-2-2504, Design of Sheet Pile Walls. Soil parameters for the design were provided for each site by the LRB Coastal/Geotechnical Team. Corps of Engineers computer program CWALSHT, Design/Analysis of Sheet Pile Walls By Classical Methods was used for the design. CWALSHT provided the required wall embedment, wall bending moments and anchor force which was then used to size all the vertical wall structural components. Bearing capacity analyses perform by the LRB Coastal/Geotechnical Team determined that wall embedments provided by CWALSHT had to be increased in order to prevent bearing failure of the underlying soil. This required increasing the wall embedments 35 feet for the E55 site and 7 feet for the 2A and 3A sites. Figures of the vertical wall systems for E55, 2A and 3A sites are contained elsewhere in this report. The vertical wall systems shown in this report are preliminary and are subject to change when the detailed design is performed.

The preliminary design of the open cell wall alternatives were performed and drawings of these alternatives were provided by PND Engineers Inc., Consulting Engineers of Seattle, Washington.

10. WATER QUALITY DESIGN CONSIDERATIONS

The purpose of each of the proposed CDFs is to remove polluted sediments from the aquatic environment. In the past, these sediments had been open-lake dumped. However, with the passage of the Clean Water Act and associated legislation, polluted sediments have been restricted from open-lake discharge. The CDF is designed to contain the polluted sediments through the use of a geotextile membrane, a thick filter layer, and limestone dike material construction. Once the dredged sediments are placed in the CDF, a number of processes occur. Adsorption of pollutants to the sediments and the settling of sediments and associated pollutants out from the water column is generally recognized as the primary pollutant removal/containment process within a CDF. Pollutants associated with dredged materials are strongly attached (adsorbed) to the organic and clay fractions. As the particulates settle out, the pollutants adsorbed to the particulates are thereby removed from the water column and contained in the sediments. The CDF is therefore designed to contain sediments while allowing water to either evaporate or flow out of the disposal facility through the dike itself or through the overflow weir.

Sites 2 and 3 and rubblemound portions of East 55th Street site

A geotextile membrane is permeable and is used at the very top of the filter layer to protect the “C” and "D" stones from migrating through the larger "B" and “E” stones which will be placed on top. The zone it protects is that which is above the water surface (early in the dike filling process) and/or that zone potentially impacted by waves generated within the CDF or subject to fluctuating water levels. The filter layer has a component size range from the # 200 sieve up to five inches in diameter.

The effluent then filters through the remainder of the dike wall. As it passes through, three processes occur - settling, adsorption and bioabsorption/biodegradation. These processes all contribute to scrubbing the effluent. Buffalo District monitoring at Cleveland and other harbors has shown no significant impairment of water or sediment quality outside the dikes due to movement of pollutants through the dikes

The overflow weir is an integral part of the CDF which helps to increase filling efficiency by draining water from the interior, with proper provisions for maintaining environmental quality standards. This discharge will only occur after the dredged reach above lake level, and even during mid-life of the CDF the ponded water may be left to evaporate. Use of the weir discharge may also be used to avoid undesirable conditions (vegetation growth, waterfowl attraction, botulism conditions, etc.) in the CDF. The overflow weir is designed with removable boards to provide for adjustable weir top elevation. The weir is designed to limit suspended solids concentration in the effluent discharge to less than 100 miligrams per liter. Testing has shown that this limit reasonably achieves State water quality standards for the lake receiving waters. In the last years of CDF life suspended solids concentrations between 100 to 200 milligrams per liter may persist. To meet State water quality standards, methods such as adding a flocculent or the use of filter materials will be used to restrict particulate and associated pollutant level outflow from the weir along with proper management of the filling regimen.

Cell 1 Alternatives 2a and 3a and Vertical Wall Portion of East 55th Street Alternative

Cell 1 of Alternatives 2a and 3a and portions of the East 55th Street site are confined largely by sheet steel pile bulkheads. These bulkheads provide a relatively impermeable barrier. However, portions of Cell 1 of Alternatives 2a and 3a and the East 55th Street site are also confined by rubblemound dikes. Therefore, it is expected that water quality design parameters will be met in the same manner as the pure rubblemound alternatives.

11. CONSTRUCTION PROCEDURE

It is anticipated that the construction of the proposed CDFs will utilize marine construction equipment for placement and grading of the rubblemound stone structure to produce the cross sections shown above and to drive the sheet steel pile cells as part of Cell 1, Alternatives 2A and 3A and the East 55th Street site CDF. Due to the East 55th Street site's connection to land, land based construction may be possible but would require significant material laydown and construction vehicle marshalling areas. Typical order of work will be established during preconstruction engineering and design and is dependent on the selected plan.

12. CONSTRUCTION MATERIALS

The results of a materials survey indicate that there are a sufficient number of sources within a 100-mile radius of the project. Sources have been identified that can produce the required stone construction materials in limited quantities. However, none of these sources has the ability to produce the amount of stone needed for the proposed CDFs in the timeframe required for construction without adding additional production capacity at the cost of the Government. Thus, prices shown in the cost estimates for the rubblemound structures, which are based on quotations from reliable quarries, result from significantly higher unit costs for stone caused to the quarries' needs to add additional labor and plant to meet the required production rates.

However, production of core stone should not be an issue, given the normal operations of large quarries such as standard LaFarge/Marblehead and Rogers City, MI, which routinely produce core stone and aggregates as their normal production.

13. CONSTRUCTION COST ESTIMATE

Feasibility-level preliminary construction cost estimates have been prepared for the CDFs included in the preferred plans. They are included in Tab F of this appendix. A summary is presented in Table 3 below.

Plan	Acres	Capacity (CY)	Cell 1	Cell 2	Cell 3	Total
Alternative 2	108	7,200,000	$241,754,000			**$241,448,088**
Alternative 3	117	7,200,000	$209,671,000			**$217,939,677**
Alternative 2a	130	7,370,000	$114,757,000	$142,160,000		**$265,711,456**
Alternative 3a	123	6,453,651	$132,200,000	$196,788,000		**$340,339,038**
East 55th Back to Back Open Cell	157	6,855,000	$113,300,000	$56,500,000	$76,300,000	**$237,928,589**
East 55th local preferred plan Combi Wall	157	6,855,000	$128,900,000	$60,700,000	$86,200,000	**$276,987,361**

Table 3: Summary of construction cost estimates of alternative plans

14. COST RISK ANALYSIS:

The cost estimates were subjected to a Cost Risk Analysis conducted by the USACE Cost DX in Walla Walla District in order to establish risk-based cost contingencies for each of the alternative plans. The cost risk analysis modeling developed the following cost contingencies at an 80% confidence level:

Plan 2: 26.06%
Plan 2a: 24.24%
Plan 3: 26.57%
Plan 3a: 24.41%
Plan 4: 24.09%
Plan 4a: 22.16%

These cost contingencies were applied to the cost estimates and are reflected in the estimates in Appendix D. The cost risk analysis effort is a continual process and will be revisited throughout the detailed design process in order to ensure reliable cost estimation.

15. ENVIRONMENTAL CONSIDERATIONS

Environmental impacts of the proposed plan are identified in Chapters 3 and 4 of this document. Chapters 2, 5, and 6 and the appendices provide addition information related to the Environmental Impact Statement.

16. PROJECT DESIGN AND CONSTRUCTION SCHEDULE

The conceptual schedule outlined below lists the key activities by fiscal year for the design and construction of the proposed CDF, as well the associated fill management plans.

FY	Task
FY09	Continue Preliminary Engineering of new CDF; conduct geotechnical investigations
	Design Phase 2 of Dike 12 FMP
	Construct Dike 9 FMP
	Dredge and fill at Dike 12
FY10	Begin Preconstruction Engineering and Design (PED) of new CDF
	Complete Design Document Report and Value Engineering Study
	Dredge and fill at Dikes 12 and 10B
FY11	Complete PED of new CDF
	Complete contract plans and specifications
	Dredge and fill at Dike 9
	Construct Phase 2 of Dike 12 FMP
FY12	Issue contract solicitation for initial construction
	Award contract
	Begin construction of new CDF (first cell)
	Dredge and fill at Dikes 12 and 9
FY13	Continue construction of new CDF (first cell)
	Dredge and fill at Dike 12
FY14	Complete construction of new CDF
	Dredge and fill at Dike 12
FY 15 – 29	Dredge and fill new CDF

17. RECOMMENDATION

It is recommended that the DMMP/EIS be approved and serve as the basis for preconstruction engineering and design for the recommended confined, diked disposal facility at Cleveland Harbor, Ohio.

Tab A
Preliminary Design Site 2

SITE 2 – PRELIMINARY DESIGN – AUGUST 2006

This preliminary design information will be used to develop cost estimates to assess the feasibility of Site 2 as a potential location for a new CDF. Detailed engineering analyses were not performed.

The proposed centerline location for a Site 2 containment dike is illustrated on Figure 1. Additional information regarding a Site 2 CDF is presented below.

Area =	108 acres
Existing lakebed elevation =	-20 to -30 feet LWD
Perimeter of new containment dike in open water =	4925 feet
Perimeter of new containment dike along W. breakwater =	3055 feet
Perimeter of new containment dike along arrowhead brkwtr. =	1155 feet
Final dredged fill elevation =	+20 feet LWD
Open volume available for dredged fill =	7.2 x 10^6 cubic yards

A typical containment dike section in open water is illustrated as Figure 2. Information regarding various material zones is presented in Table 1.

A typical containment dike section along the West Breakwater is illustrated as Figure 3. Information regarding various material zones is presented in Table 2.

A typical containment dike section along the Arrowhead Breakwater is illustrated as Figure 4. Information regarding various material zones is presented in Table 3.

A weir structure, similar to that used at existing Dike 10B, will be needed at Site 3.

Appendix A includes preliminary stability analyses and volume calculations.

SITE 2 - PROPOSED CONTAINMENT DIKE LOCATION

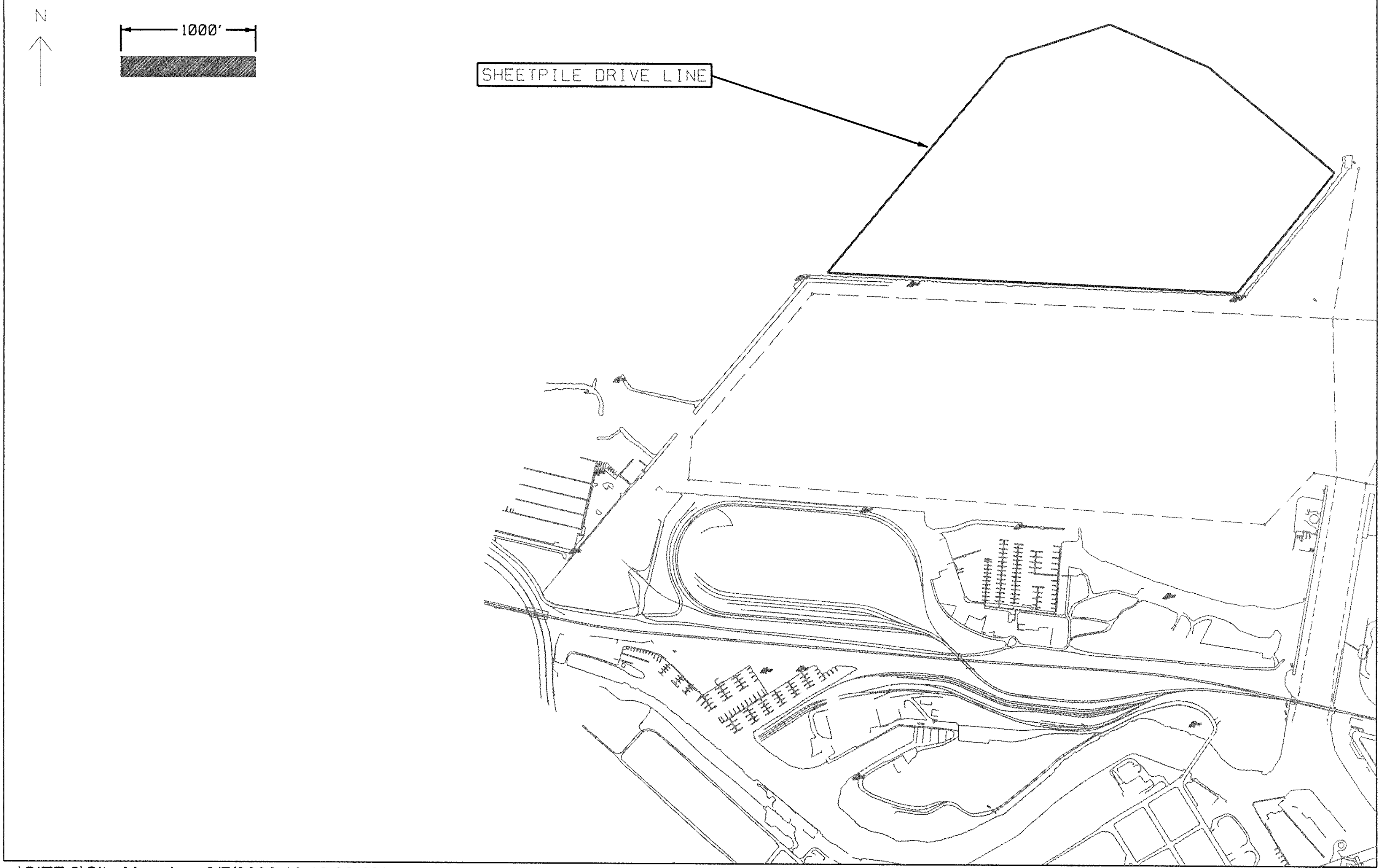

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Figure 1

SITE 2 - TYPICAL OPEN-WATER SECTION

NOT SUPPORTED BY DETAILED ENGINEERING ANALYSES.
FOR PRELIMINARY COST ESTIMATING PURPOSES ONLY.

PRIOR TO PLACING MATERIAL ABOVE -15 LWD
ALL MATERIAL BELOW -15 LWD MUST BE PLACED.

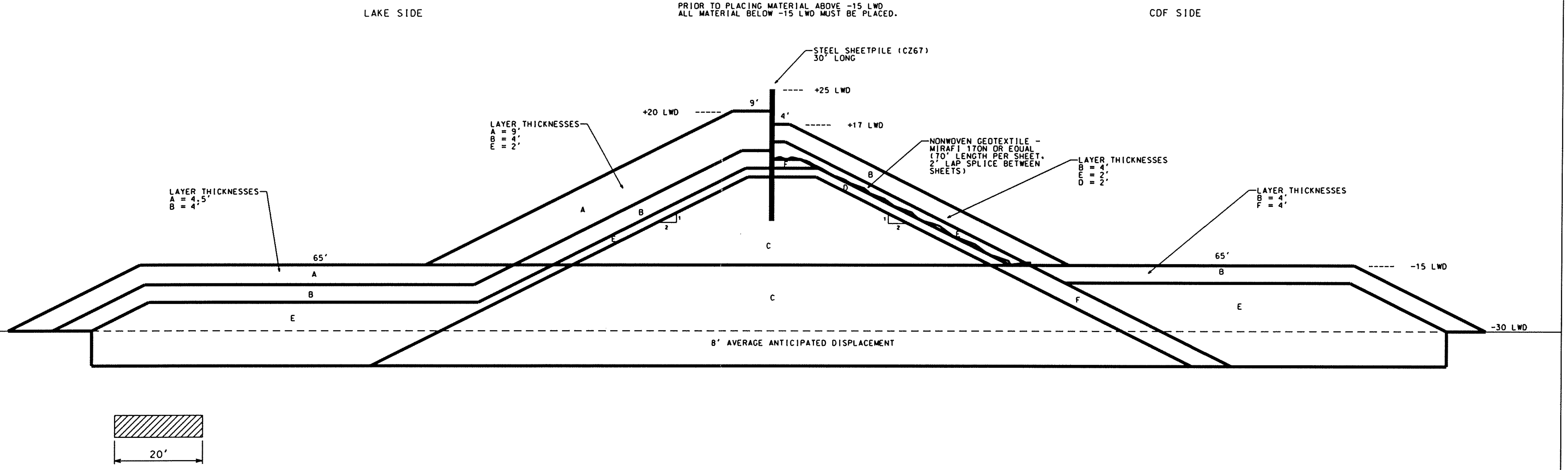

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Figure 2

SITE 2 - TYPICAL SECTION ALONG W. BREAKWATER

NOT SUPPORTED BY DETAILED ENGINEERING ANALYSES.
FOR PRELIMINARY COST ESTIMATING PURPOSES ONLY.

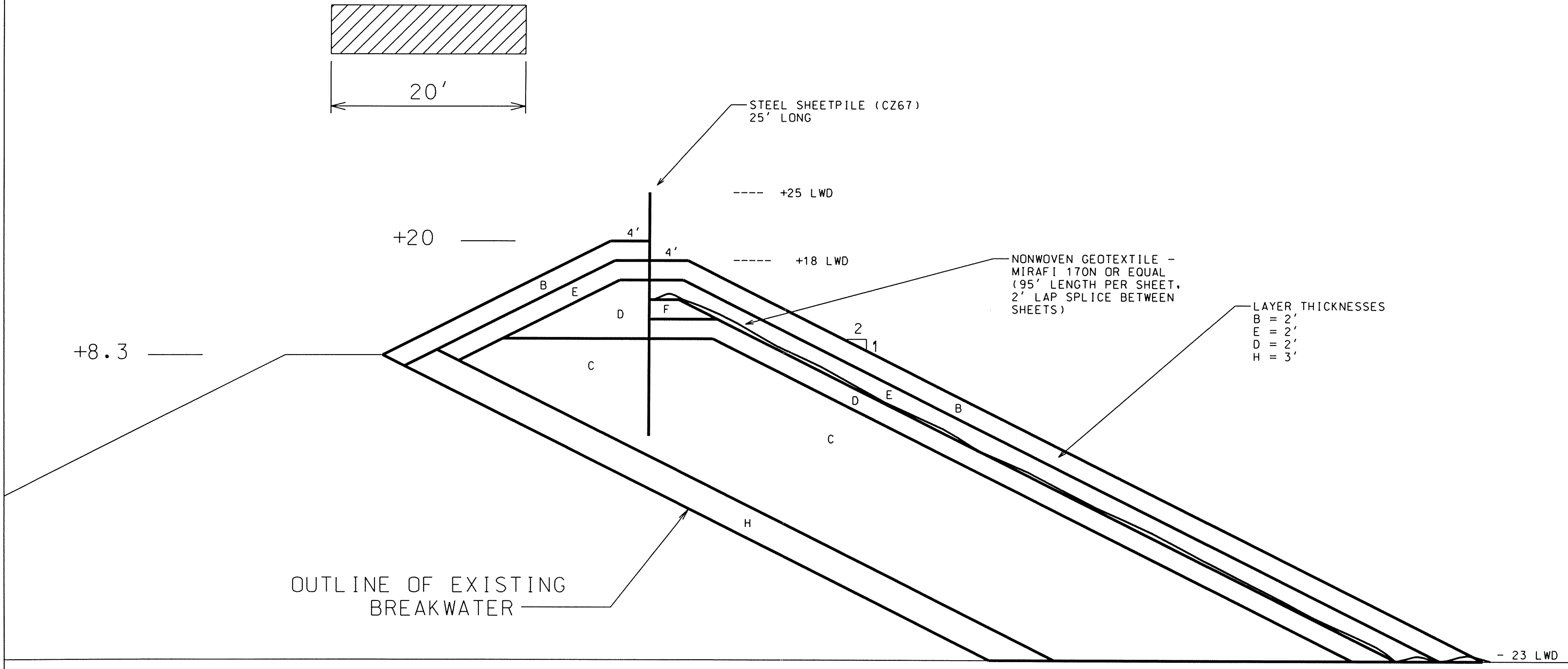

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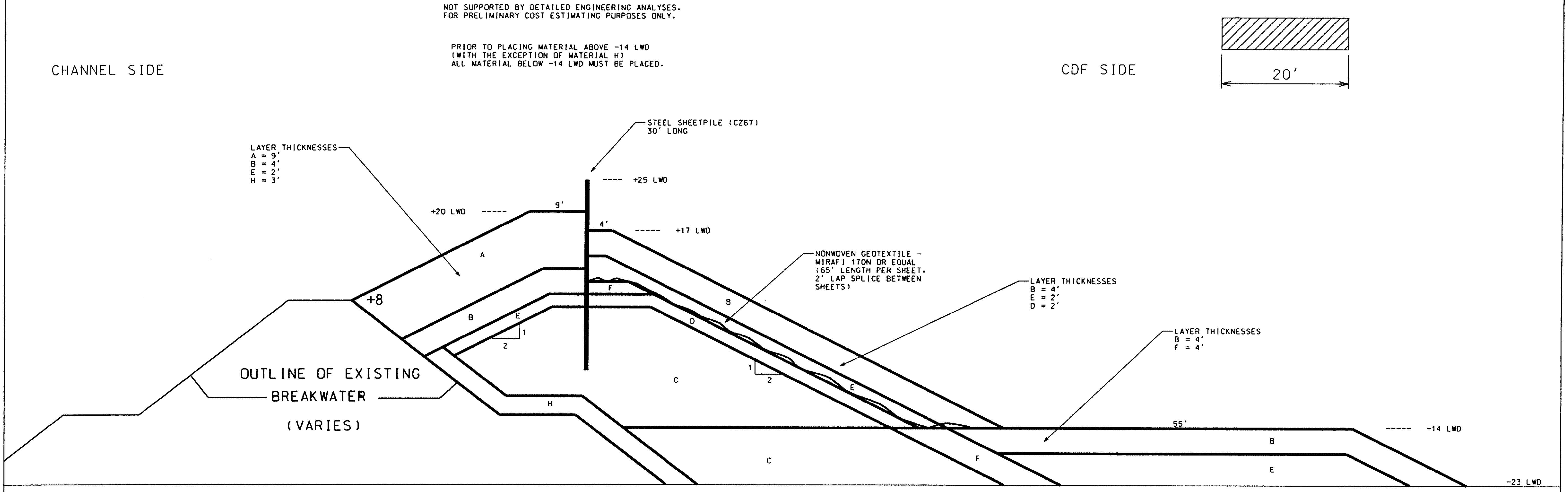
Figure 3

SITE 2 - TYPICAL SECTION ALONG ARROWHEAD BREAKWATER



NOT SUPPORTED BY DETAILED ENGINEERING ANALYSES.
FOR PRELIMINARY COST ESTIMATING PURPOSES ONLY.

PRIOR TO PLACING MATERIAL ABOVE -14 LWD
(WITH THE EXCEPTION OF MATERIAL H)
ALL MATERIAL BELOW -14 LWD MUST BE PLACED.

...\SITE 2\Site 2 arrowhead.dgn 8/3/2006 3:20:17 PM

Figure 4

Material	Size Specification	Physical Properties Specification	In-place volume per lineal foot (CF)	Maximum volume (in-place) to weight (shipping) conversion factor (PCF)	Minimum volume (in-place) to weight (shipping) conversion factor (PCF)
F	ODOT 703.01 Size No. 68	ODOT 703.16C	223	135 (stone with $G_s = 2.72$, $n = 26\%$, $w = 7\%$)	70 (dry slag)
E	ODOT 703.19B Type D	ODOT 703.19B	2539	130 (stone with $G_s = 2.72$, $n = 26\%$, $w = 3\%$)	100 (RPCC with $G_s = 2.32$, $n = 31\%$)
D	ODOT 703.19A Crushed Aggregate	ODOT 703.19A	115	130 (stone with $G_s = 2.72$, $n = 26\%$, $w = 3\%$)	70 (dry slag)
C	ODOT 703.19B Type D Or ODOT 703.01 Sizes No. 1 through 5 inclusive	ODOT 703.19B Or ODOT 703.19A	4368	130 (stone with $G_s = 2.72$, $n = 26\%$, $w = 3\%$)	70 (dry slag)
A	5 to 10 ton	Similar to past USACE specifications	1174	124 (stone with $G_s = 2.72$, $n = 27\%$)	107 (stone with $G_s = 2.58$, $n = 33\%$)
B	600 lb. to 2000 lb.	Similar to past USACE specifications	1350	124 (stone with $G_s = 2.72$, $n = 27\%$)	107 (stone with $G_s = 2.58$, $n = 33\%$)

G_s = Specific gravity
n = Porosity of in-place material
w = Moisture content of material as shipped
RPCC = Recycled Portland Cement Concrete

Table 1 – Site 2 Containment Dike Materials Typical Open-Water Section

Material	Size Specification	Physical Properties Specification	In-place volume per lineal foot (CF)	Maximum volume (in-place) to weight (shipping) conversion factor (PCF)	Minimum volume (in-place) to weight (shipping) conversion factor (PCF)
H	ODOT 703.19B Type C	ODOT 703.19B	208	130 (stone with $G_s = 2.72$, $n = 26\%$, $w = 3\%$)	100 (RPCC with $G_s = 2.32$, $n = 31\%$)
F	ODOT 703.01 Size No. 68	ODOT 703.16C	10	135 (stone with $G_s = 2.72$, $n = 26\%$, $w = 7\%$)	70 (dry slag)
E	ODOT 703.19B Type D	ODOT 703.19B	223	130 (stone with $G_s = 2.72$, $n = 26\%$, $w = 3\%$)	100 (RPCC with $G_s = 2.32$, $n = 31\%$)
D	ODOT 703.19A Crushed Aggregate	ODOT 703.19A	220	130 (stone with $G_s = 2.72$, $n = 26\%$, $w = 3\%$)	70 (dry slag)
C	ODOT 703.19B Type D Or ODOT 703.01 Sizes No. 1 through 5 inclusive	ODOT 703.19B Or ODOT 703.19A	1002	130 (stone with $G_s = 2.72$, $n = 26\%$, $w = 3\%$)	70 (dry slag)
A	5 to 10 ton	Similar to past USACE specifications	0	124 (stone with $G_s = 2.72$, $n = 27\%$)	107 (stone with $G_s = 2.58$, $n = 33\%$)
B	600 lb. to 2000 lb.	Similar to past USACE specifications	244	124 (stone with $G_s = 2.72$, $n = 27\%$)	107 (stone with $G_s = 2.58$, $n = 33\%$)

G_s = Specific gravity
n = Porosity of in-place material
w = Moisture content of material as shipped
RPCC = Recycled Portland Cement Concrete

Table 2 – Site 2 Containment Dike Materials, Typical W. Breakwater Section

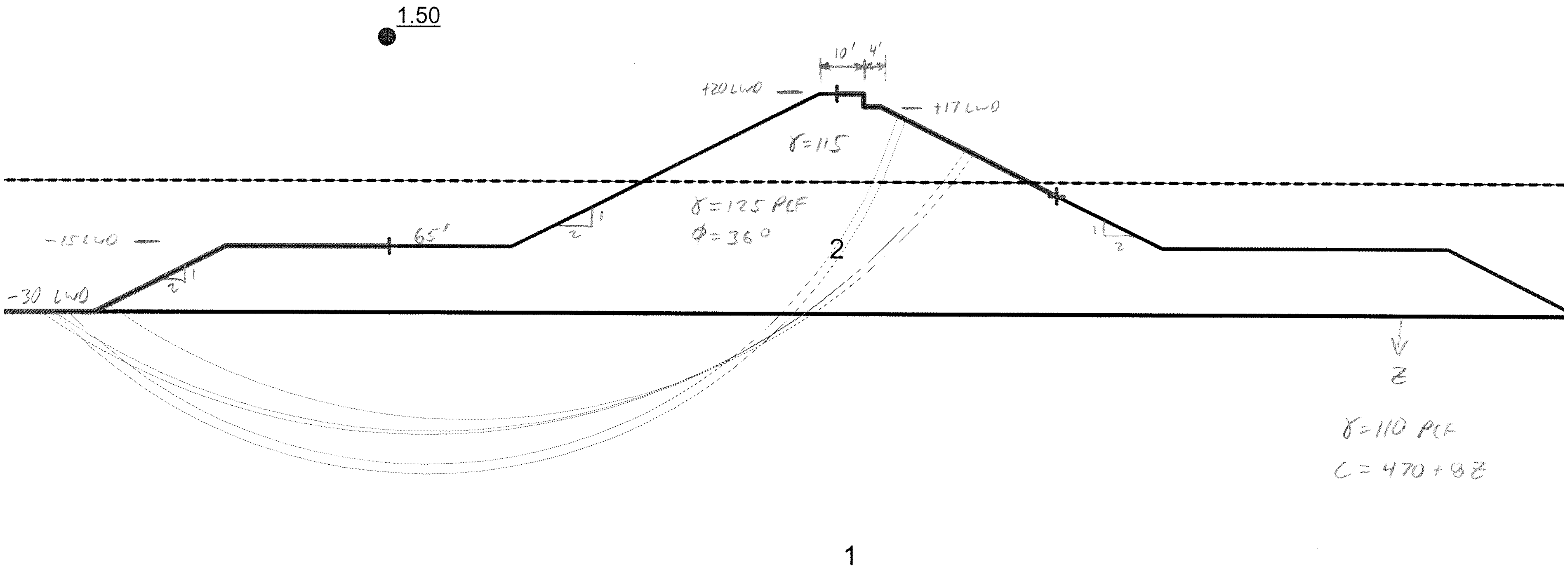
Material	Size Specification	Physical Properties Specification	In-place volume per lineal foot (CF)	Maximum volume (in-place) to weight (shipping) conversion factor (PCF)	Minimum volume (in-place) to weight (shipping) conversion factor (PCF)
H	ODOT 703.19B Type C	ODOT 703.19B	139	130 (stone with $G_s = 2.72$, $n = 26\%$, $w = 3\%$)	100 (RPCC with $G_s = 2.32$, $n = 31\%$)
F	ODOT 703.01 Size No. 68	ODOT 703.16C	97	135 (stone with $G_s = 2.72$, $n = 26\%$, $w = 7\%$)	70 (dry slag)
E	ODOT 703.19B Type D	ODOT 703.19B	453	130 (stone with $G_s = 2.72$, $n = 26\%$, $w = 3\%$)	100 (RPCC with $G_s = 2.32$, $n = 31\%$)
D	ODOT 703.19A Crushed Aggregate	ODOT 703.19A	110	130 (stone with $G_s = 2.72$, $n = 26\%$, $w = 3\%$)	70 (dry slag)
C	ODOT 703.19B Type D Or ODOT 703.01 Sizes No. 1 through 5 inclusive	ODOT 703.19B Or ODOT 703.19A	1154	130 (stone with $G_s = 2.72$, $n = 26\%$, $w = 3\%$)	70 (dry slag)
A	5 to 10 ton	Similar to past USACE specifications	324	124 (stone with $G_s = 2.72$, $n = 27\%$)	107 (stone with $G_s = 2.58$, $n = 33\%$)
B	600 lb. to 2000 lb.	Similar to past USACE specifications	693	124 (stone with $G_s = 2.72$, $n = 27\%$)	107 (stone with $G_s = 2.58$, $n = 33\%$)

G_s = Specific gravity
n = Porosity of in-place material
w = Moisture content of material as shipped
RPCC = Recycled Portland Cement Concrete

Table 3 – Site 2 Containment Dike Materials, Typical Arwhd. Brkwtr. Section

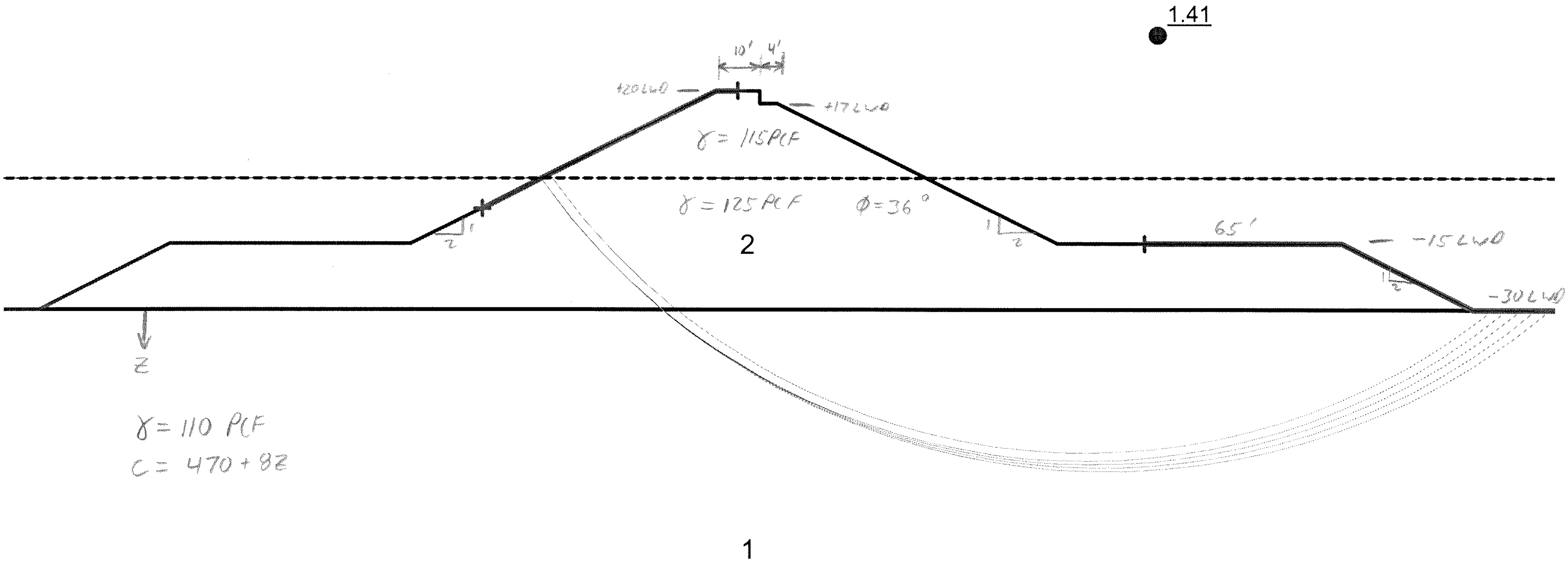
APPENDIX A

File : Site 2



1.50
10'
4'
+20 LWD
+17 LWD
γ=115
γ=125 PCF
φ=36°
2
1
2
-15 LWD
65'
1
2
-30 LWD
1
2
1
2
Z
γ=110 PCF
C = 470 + 8Z
1

File: Site 2 reverse



Originator:
Date:
Project:
Subject: Site 2 Open Volume Calcs

Page ____ of ____

Depth (ft)	Avg. elev.	Offset from Sheetpile Open	 W. Brk.	 Arrowhead	Area (ft²)	Height (ft)
-26 To -15	-20.5	144'	81'	135'	3.674×10^6	11'
-15 To -14	-14.5	67'	69'	121'	4.065×10^6	1'
-14 To +17	+1.5	35'	37'	35'	4.401×10^6	31'
+17 To +18	+17.5	0'	5'	0'	4.706×10^6	1'
+18 To +20	+19	0'	0'	0'	4.721×10^6	2'

$$
\begin{aligned}
\text{Volume} &= 3.67 \times 10^6\ ft^2 \times 11' \\
&\quad + 4.06 \times 10^6\ ft^2 \times 1' \\
&\quad + 4.40 \times 10^6\ ft^2 \times 31' \\
&\quad + 4.71 \times 10^6\ ft^2 \times 1' \\
&\quad + 4.72 \times 10^6\ ft^2 \times 2' \\
&= 7.2 \times 10^6\ CY
\end{aligned}
$$

Checked By:

Tab B
Preliminary Design Site 3

SITE 3 – PRELIMINARY DESIGN – AUGUST 2006

This preliminary design information will be used to develop cost estimates to assess the feasibility of Site 3 as a potential location for a new CDF. Detailed engineering analyses were not performed.

The proposed centerline location for a Site 3 containment dike is illustrated on Figure 1. Additional information regarding a Site 3 CDF is presented below.

Area = 129 acres
Existing lakebed elevation = -16 to -27 feet LWD
Perimeter of new containment dike in open water = 5430 feet
Perimeter of new containment dike along E. breakwater = 2990 feet
Perimeter of new containment dike along arrowhead brkwtr. = 1010 feet
Final dredged fill elevation = +20 feet LWD
Open volume available for dredged fill = 8.0×10^6 cubic yards

A typical containment dike section in open water is illustrated as Figure 2. Information regarding various material zones is presented in Table 1.

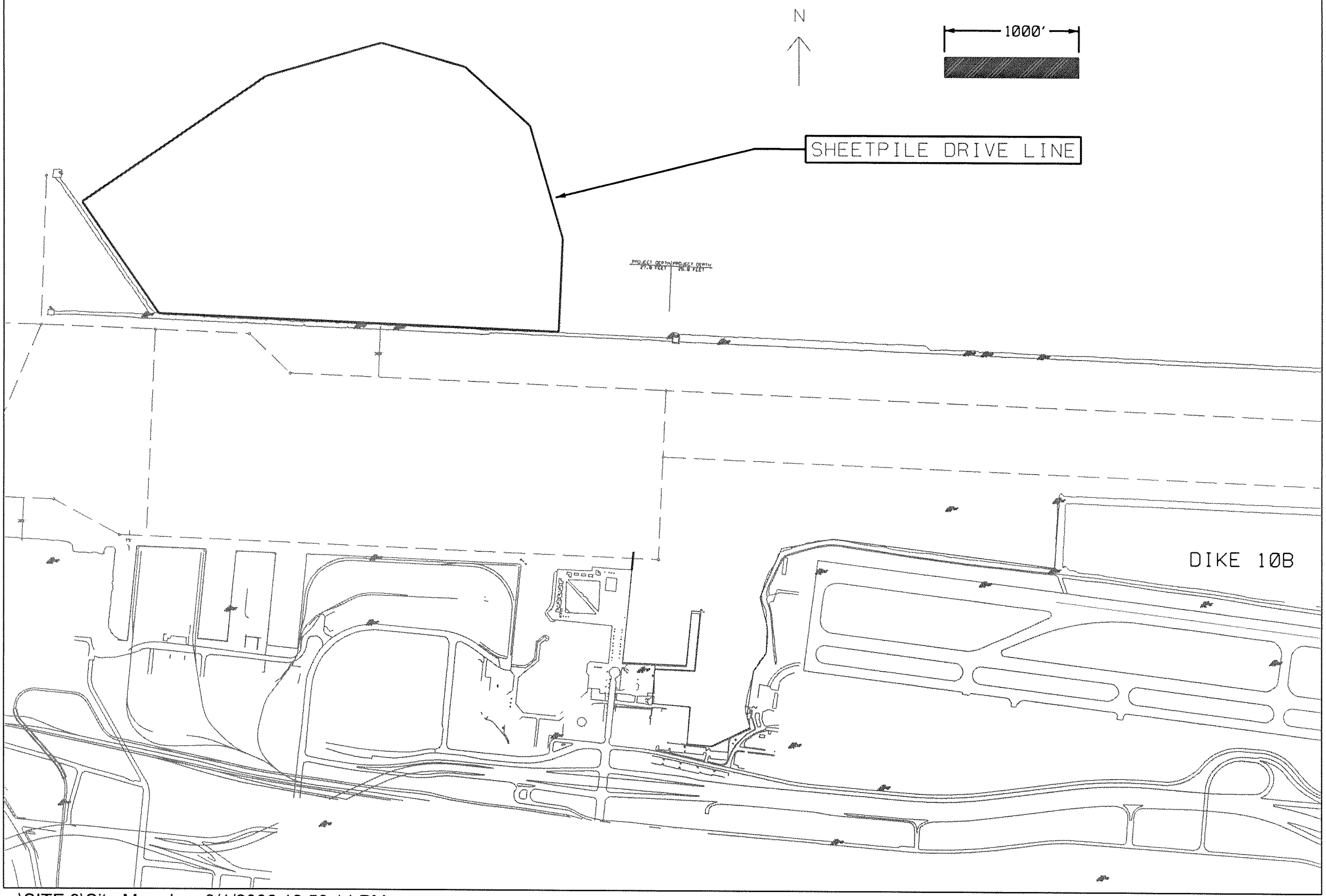
A typical containment dike section along the East Breakwater is illustrated as Figure 3. Information regarding various material zones is presented in Table 2.

A typical containment dike section along the Arrowhead Breakwater is illustrated as Figure 4. Information regarding various material zones is presented in Table 3.

A weir structure, similar to that used at existing Dike 10B, will be needed at Site 3.

Appendix A includes preliminary stability analyses and volume calculations.

SITE 3 - PROPOSED CONTAINMENT DIKE LOCATION



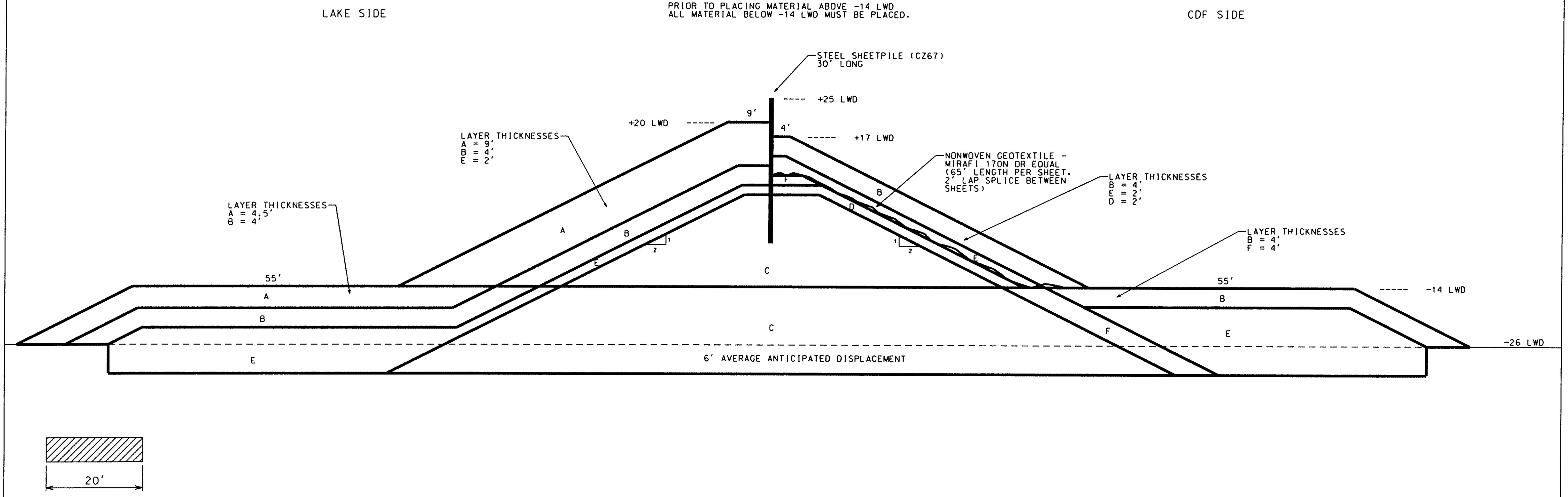
...\SITE 3\Site Map.dgn 8/1/2006 12:58:14 PM

Figure 1

SITE 3 - TYPICAL OPEN-WATER SECTION

NOT SUPPORTED BY DETAILED ENGINEERING ANALYSES.
FOR PRELIMINARY COST ESTIMATING PURPOSES ONLY.

PRIOR TO PLACING MATERIAL ABOVE -14 LWD
ALL MATERIAL BELOW -14 LWD MUST BE PLACED.

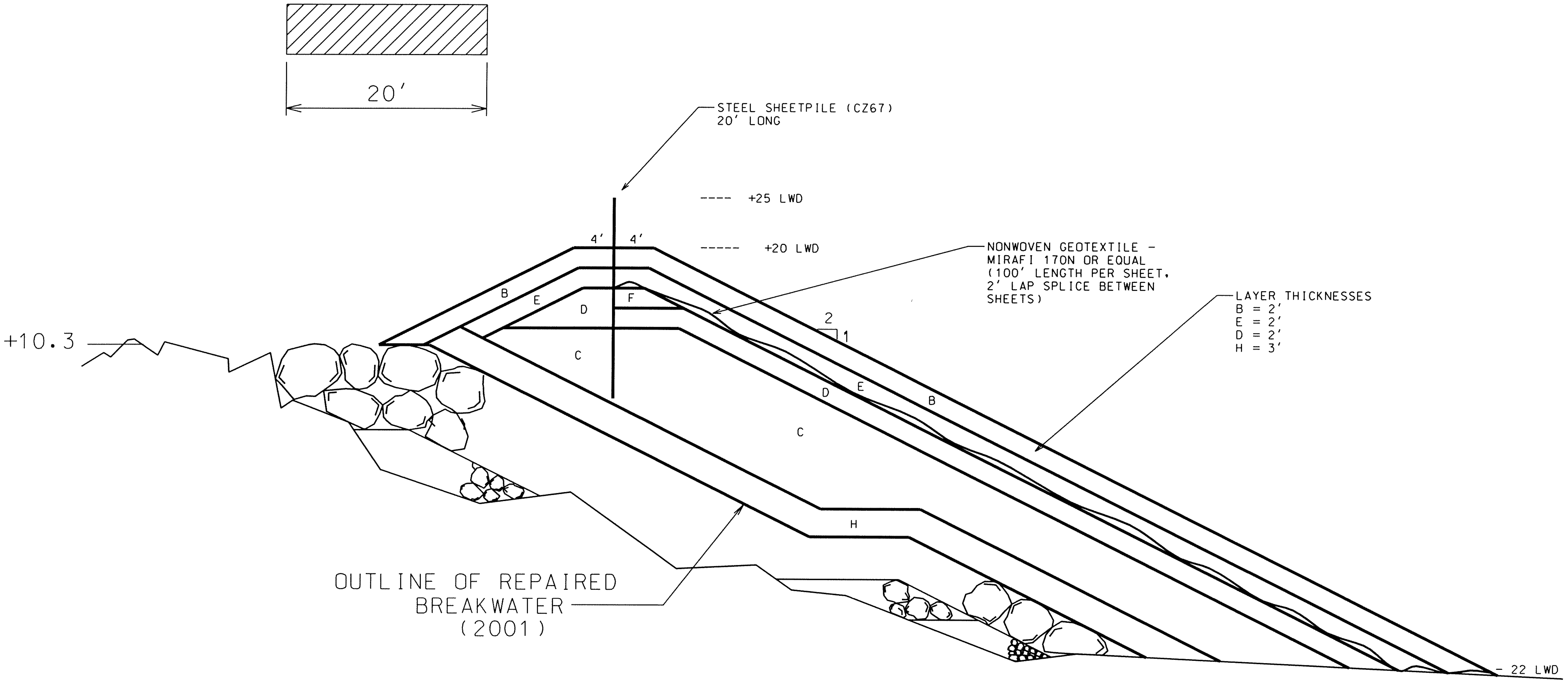


...\Site 3.dgn 8/1/2006 9:04:56 AM

Figure 2

SITE 3 – TYPICAL SECTION ALONG E. BREAKWATER

NOT SUPPORTED BY DETAILED ENGINEERING ANALYSES.
FOR PRELIMINARY COST ESTIMATING PURPOSES ONLY.



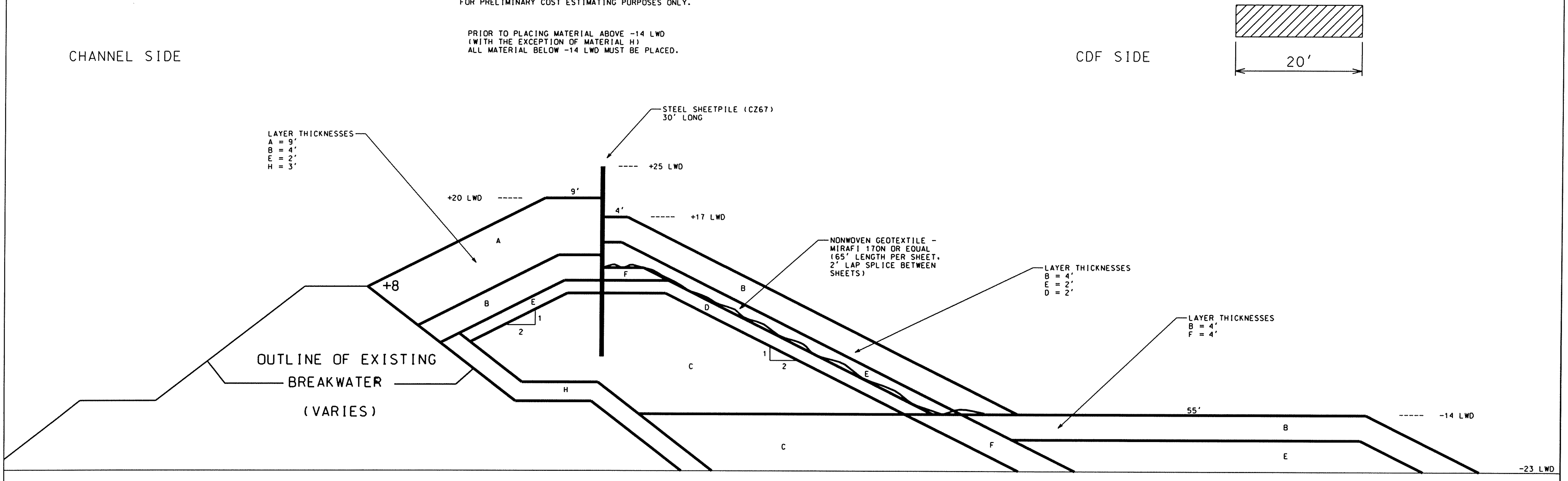
...\Site 3 east breakwater.dgn 8/1/2006 9:25:36 AM

Figure 3

SITE 3 - TYPICAL SECTION ALONG ARROWHEAD BREAKWATER

NOT SUPPORTED BY DETAILED ENGINEERING ANALYSES.
FOR PRELIMINARY COST ESTIMATING PURPOSES ONLY.

PRIOR TO PLACING MATERIAL ABOVE -14 LWD
(WITH THE EXCEPTION OF MATERIAL H)
ALL MATERIAL BELOW -14 LWD MUST BE PLACED.



...\Site 3 arrowhead.dgn 8/1/2006 9:54:33 AM

Figure 4

Material	**Size Specification**	**Physical Properties Specification**	**In-place volume per lineal foot (CF)**	**Maximum volume (in-place) to weight (shipping) conversion factor (PCF)**	**Minimum volume (in-place) to weight (shipping) conversion factor (PCF)**
F	ODOT 703.01 Size No. 68	ODOT 703.16C	178	135 (stone with $G_s = 2.72$, $n = 26\%$, $w = 7\%$)	70 (dry slag)
E	ODOT 703.19B Type D	ODOT 703.19B	1629	130 (stone with $G_s = 2.72$, $n = 26\%$, $w = 3\%$)	100 (RPCC with $G_s = 2.32$, $n = 31\%$)
D	ODOT 703.19A Crushed Aggregate	ODOT 703.19A	110	130 (stone with $G_s = 2.72$, $n = 26\%$, $w = 3\%$)	70 (dry slag)
C	ODOT 703.19B Type D Or ODOT 703.01 Sizes No. 1 through 5 inclusive	ODOT 703.19B Or ODOT 703.19A	3314	130 (stone with $G_s = 2.72$, $n = 26\%$, $w = 3\%$)	70 (dry slag)
A	5 to 10 ton	Similar to past USACE specifications	1079	124 (stone with $G_s = 2.72$, $n = 27\%$)	107 (stone with $G_s = 2.58$, $n = 33\%$)
B	600 lb. to 2000 lb.	Similar to past USACE specifications	1199	124 (stone with $G_s = 2.72$, $n = 27\%$)	107 (stone with $G_s = 2.58$, $n = 33\%$)

G_s = Specific gravity
n = Porosity of in-place material
w = Moisture content of material as shipped
RPCC = Recycled Portland Cement Concrete

Table 1 – Site 3 Containment Dike Materials Typical Open-Water Section

Material	Size Specification	Physical Properties Specification	In-place volume per lineal foot (CF)	Maximum volume (in-place) to weight (shipping) conversion factor (PCF)	Minimum volume (in-place) to weight (shipping) conversion factor (PCF)
H	ODOT 703.19B Type C	ODOT 703.19B	258	130 (stone with $G_s = 2.72$, $n = 26\%$, $w = 3\%$)	100 (RPCC with $G_s = 2.32$, $n = 31\%$)
F	ODOT 703.01 Size No. 68	ODOT 703.16C	10	135 (stone with $G_s = 2.72$, $n = 26\%$, $w = 7\%$)	70 (dry slag)
E	ODOT 703.19B Type D	ODOT 703.19B	212	130 (stone with $G_s = 2.72$, $n = 26\%$, $w = 3\%$)	100 (RPCC with $G_s = 2.32$, $n = 31\%$)
D	ODOT 703.19A Crushed Aggregate	ODOT 703.19A	169	130 (stone with $G_s = 2.72$, $n = 26\%$, $w = 3\%$)	70 (dry slag)
C	ODOT 703.19B Type D Or ODOT 703.01 Sizes No. 1 through 5 inclusive	ODOT 703.19B Or ODOT 703.19A	566	130 (stone with $G_s = 2.72$, $n = 26\%$, $w = 3\%$)	70 (dry slag)
A	5 to 10 ton	Similar to past USACE specifications	0	124 (stone with $G_s = 2.72$, $n = 27\%$)	107 (stone with $G_s = 2.58$, $n = 33\%$)
B	600 lb. to 2000 lb.	Similar to past USACE specifications	245	124 (stone with $G_s = 2.72$, $n = 27\%$)	107 (stone with $G_s = 2.58$, $n = 33\%$)

G_s = Specific gravity
n = Porosity of in-place material
w = Moisture content of material as shipped
RPCC = Recycled Portland Cement Concrete

Table 2 – Site 3 Containment Dike Materials, Typical E. Breakwater Section

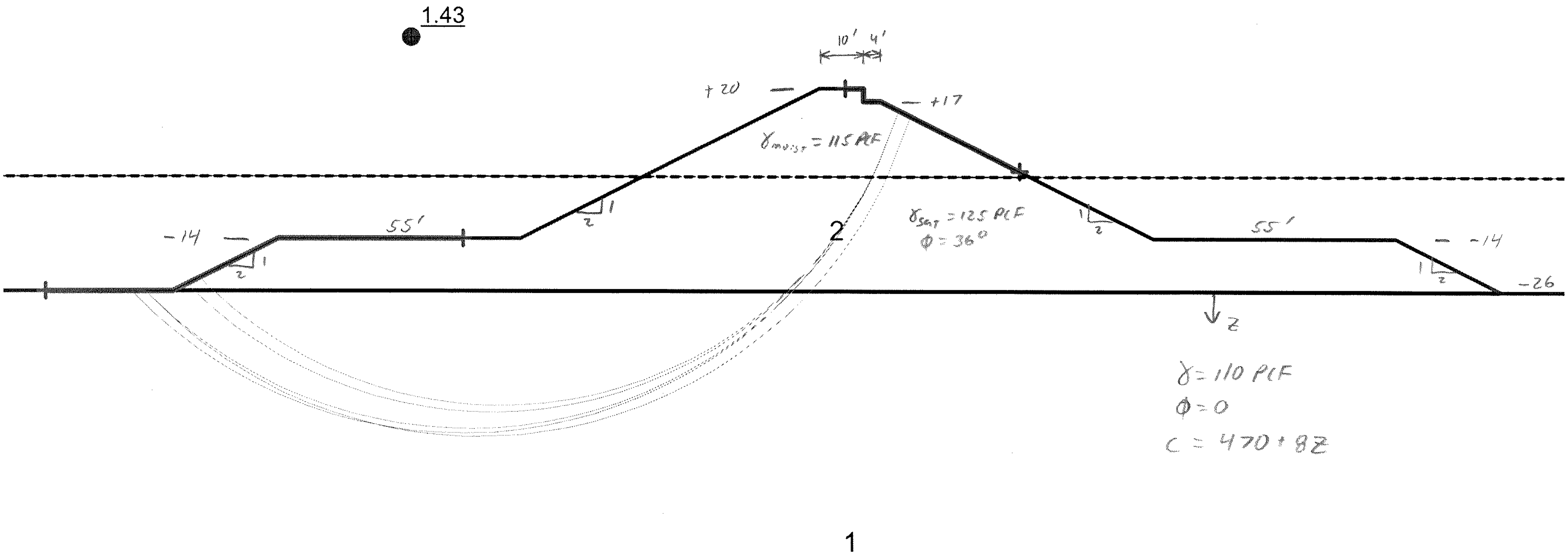
Material	Size Specification	Physical Properties Specification	In-place volume per lineal foot (CF)	Maximum volume (in-place) to weight (shipping) conversion factor (PCF)	Minimum volume (in-place) to weight (shipping) conversion factor (PCF)
H	ODOT 703.19B Type C	ODOT 703.19B	139	130 (stone with $G_s = 2.72$, $n = 26\%$, $w = 3\%$)	100 (RPCC with $G_s = 2.32$, $n = 31\%$)
F	ODOT 703.01 Size No. 68	ODOT 703.16C	97	135 (stone with $G_s = 2.72$, $n = 26\%$, $w = 7\%$)	70 (dry slag)
E	ODOT 703.19B Type D	ODOT 703.19B	453	130 (stone with $G_s = 2.72$, $n = 26\%$, $w = 3\%$)	100 (RPCC with $G_s = 2.32$, $n = 31\%$)
D	ODOT 703.19A Crushed Aggregate	ODOT 703.19A	110	130 (stone with $G_s = 2.72$, $n = 26\%$, $w = 3\%$)	70 (dry slag)
C	ODOT 703.19B Type D Or ODOT 703.01 Sizes No. 1 through 5 inclusive	ODOT 703.19B Or ODOT 703.19A	1154	130 (stone with $G_s = 2.72$, $n = 26\%$, $w = 3\%$)	70 (dry slag)
A	5 to 10 ton	Similar to past USACE specifications	324	124 (stone with $G_s = 2.72$, $n = 27\%$)	107 (stone with $G_s = 2.58$, $n = 33\%$)
B	600 lb. to 2000 lb.	Similar to past USACE specifications	693	124 (stone with $G_s = 2.72$, $n = 27\%$)	107 (stone with $G_s = 2.58$, $n = 33\%$)

G_s = Specific gravity
n = Porosity of in-place material
w = Moisture content of material as shipped
RPCC = Recycled Portland Cement Concrete

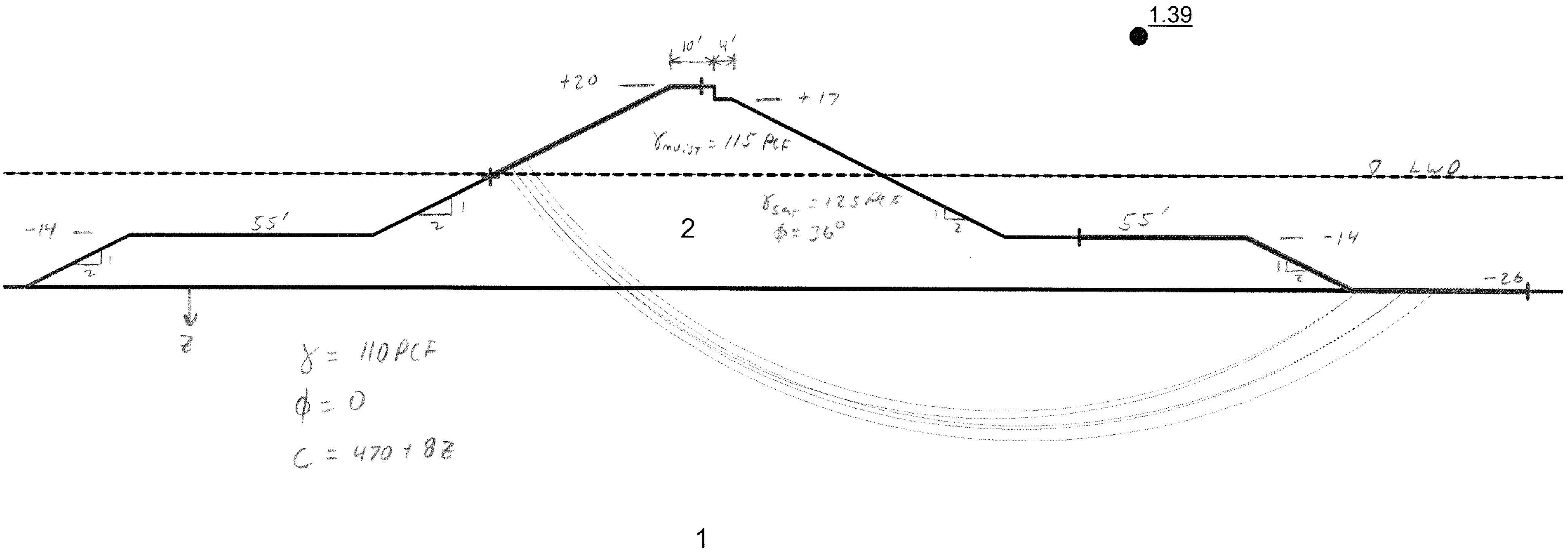
Table 3 – Site 3 Containment Dike Materials, Typical Arwhd. Brkwtr. Section

APPENDIX A

File : Site 3


1.43
10'
4'
+20
+17
γ_{moist} = 115 PCF
γ_{sat} = 125 PCF
ϕ = 36°
2
-14
55'
1
2
55'
1
2
-14
1
2
-26
z
γ = 110 PCF
ϕ = 0
c = 470 + 8Z
1

File : Site 3 reverse



US Army Corps
of Engineers
Buffalo District

Originator:
Date:
Project:
Subject: Site 3 Open Volume Calcs

Page ____ of ____

	Avg.	Offset From Sheetpile				
Depth (ft)	Elev.	Open	E. Brk.	Arrow Brk.	Area (ft²)	Height (ft)
-22 TO -14	-18	129'	80'	129'	4,583,277	8'
-14 TO +17	+1.5	35'	41'	35'	5,260,000	31'
+17 TO +20	+18.5	0'	7'	0'	5,582,273	3'

Volume $= 4.58 \times 10^6 \text{ ft}^2 \times 8'$

$+$

$5.26 \times 10^6 \text{ ft}^2 \times 31'$

$+$

$5.58 \times 10^6 \text{ ft}^2 \times 3'$

$$\boxed{= 8.0 \times 10^6 \text{ CY}}$$

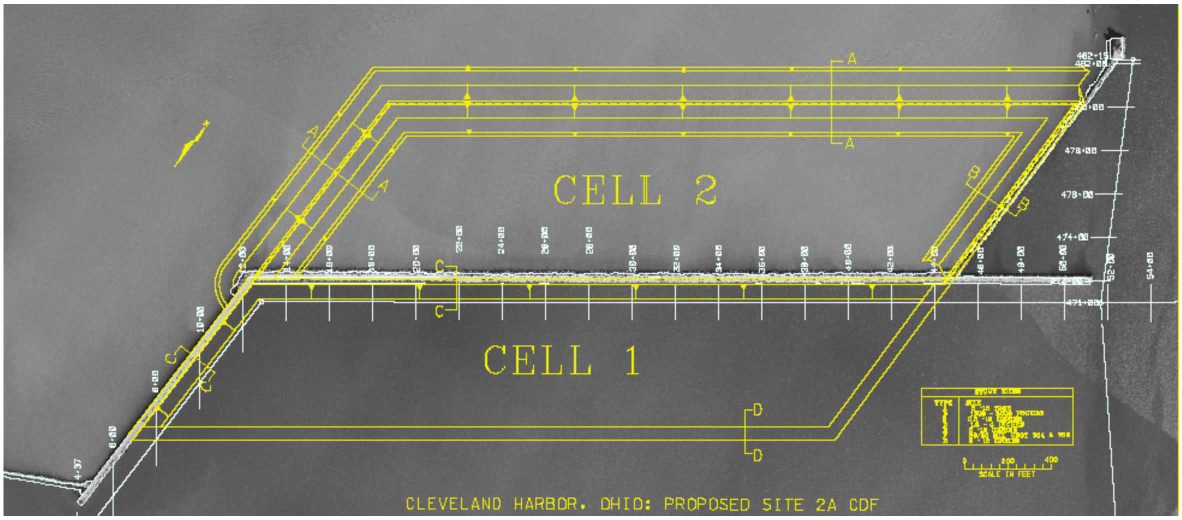
Checked By:

Tab C
Preliminary Design Alternative Site 2a

Cleveland Site 2A CDF
Preliminary Volume Computations
August 2008

A. Introduction

The purpose of this report is to determine the preliminary capacity for the proposed Confined Disposal Facility (CDF) adjacent to the main entrance to Cleveland Harbor along the West Arrowhead Breakwater (see Insert 1). The outer cell would be bounded by rubble mound breakwaters, with the west and south sides overlaying existing structures. The inner cell is bounded by steel sheet pile cells, with that area planned to be used for port facilities once the CDF is filled.



Insert 1. Location of Proposed CDF

The stone for the outer CDF would be have a crest elevation of about +20 ft Low Water Datum (LWD) and have steel sheet pile driven along its crest with a crest elevation of +25 ft LWD to minimize wave overtopping. The crest elevation of the port facilities was set at +10 ft LWD. The plan and typical cross-sections are presented in Figures 1 through 5.

B. Volume Computations

1. **General Area** – The potential interior volume of the CDF was determined by estimating the volume bounded by the steel sheetpile and subsequently subtracting the volume occupied by the stone structures. The gross volume was determined by generating a digital terrain model (DTM) for the existing bottom, as depicted by a current NOAA chart and channel sounding within the harbor obtained in 2007, and the top elevation of the CDF at +10 ft LWD for Cell 1 or +20 ft LWD for Cell 2. Subtracting these two DTMs resulted in the gross

volume within that area. The volume was also determined with the top of the dredged material at one-foot and two-feet below these elevations.

2. **Deductions for Stone Breakwaters -** The volume occupied by the stone structures was based upon the typical section outlines presented on Figures 2-5. The area inward of the sheetpile multiplied by its respective length resulted in the volume.

3. **Total –** Table 1 presents the gross volume within the sheetpile boundary and the reductions due to the stone dikes. Volumes were determined for the top of the dredge material at 0-, 1-, and 2-feet below the CDF crest elevation of the top elevation of the CDF at +10 ft LWD for Cell 1 or +20 ft LWD for Cell 2. The time to reach that capacity was determined by assuming a fill rate of 338,220 cubic yards per year.

Table 1. Cleveland Site 2A CDF Capacity

CELL	FILL ELEVATION – FEET LWD	CAPACITY – CUBIC YARDS	CAPACITY - YEARS
1	+10	2,620,000	7.7
	+9	2,520,000	7.5
	+8	2,430,000	7.2
2	+20	4,490,000	13.3
	+19	4,390,000	13.0
	+18	4,290,000	12.7

C. Conclusion

Based upon the aforementioned analysis which used preliminary cross-sections and bottom elevations obtained from a nautical chart and inner harbor channel soundings obtained in 2007, it is estimated that the proposed cells would have a capacity of approximately 7.2 – 7.7 and 12.7 to 13.3 years for Cells 1 and 2, respectively. The maximum capacity of the entire project would be approximately 21.0 years.

SITE 2 (SMALL) - PROPOSED CONTAINMENT DIKE LOCATION

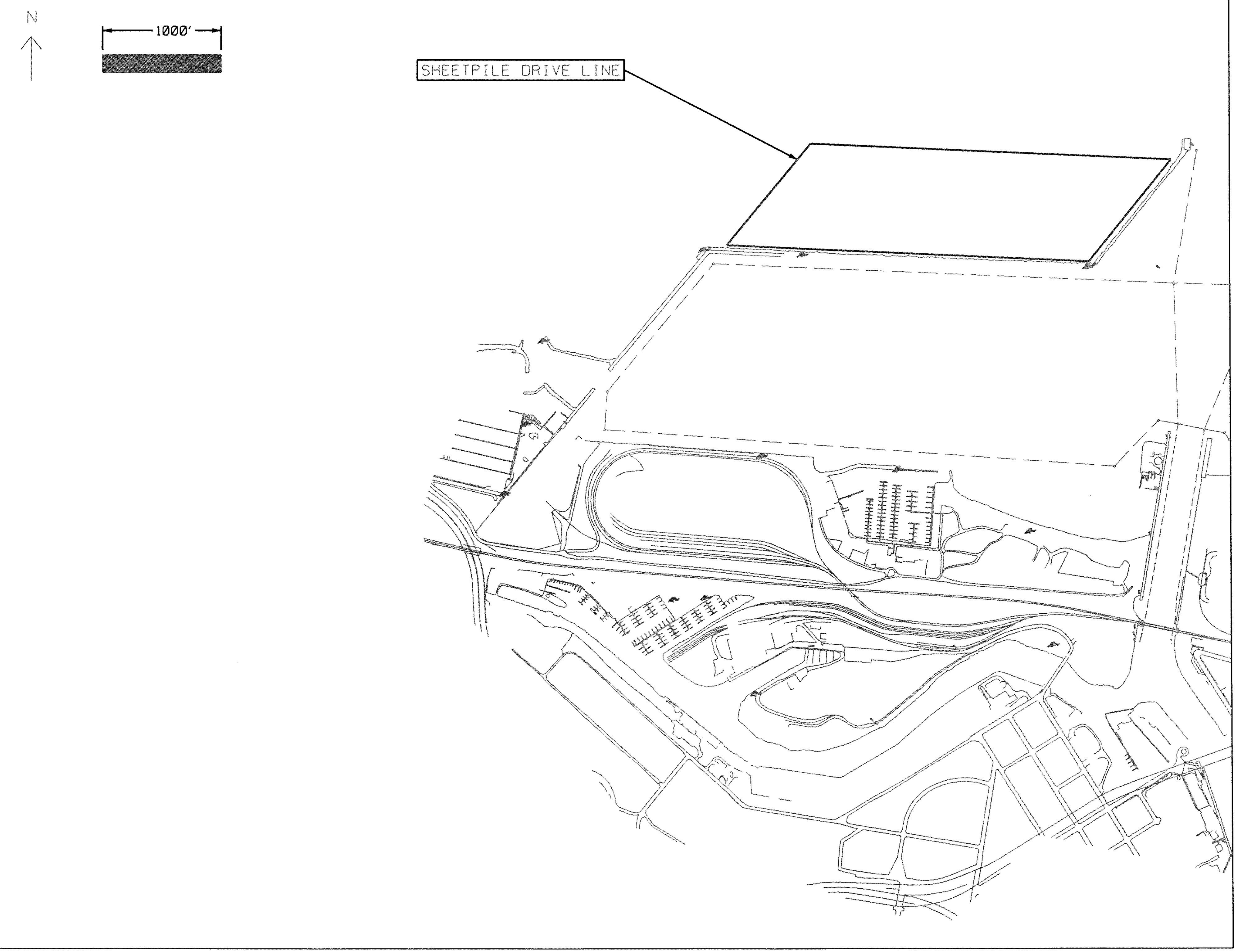


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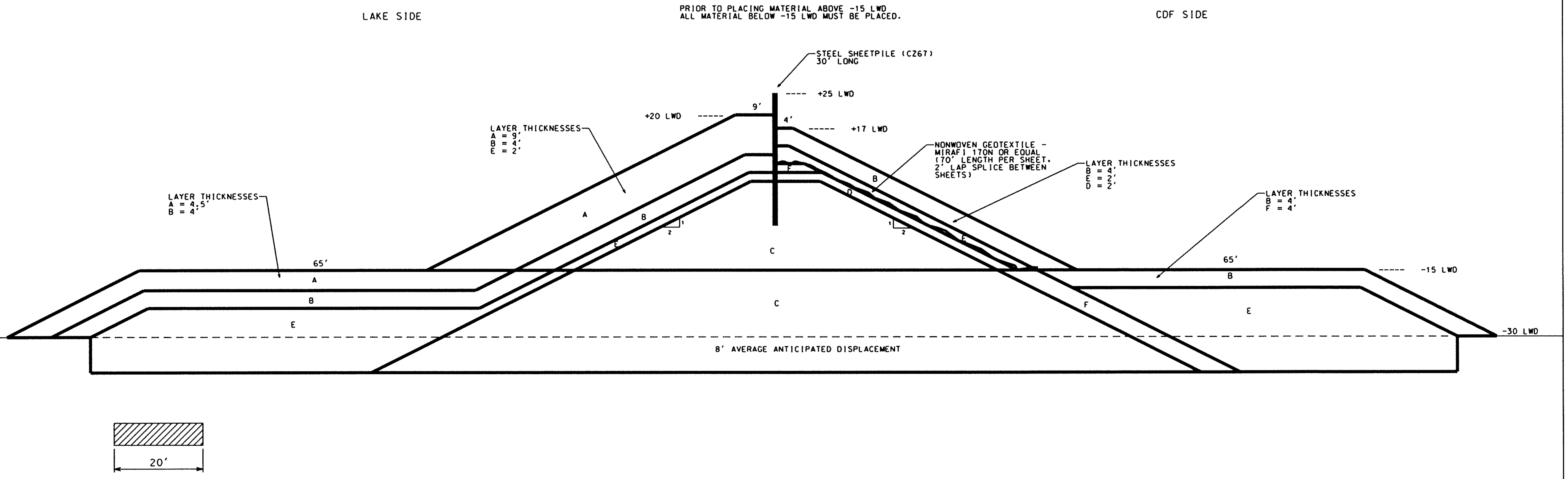
Figure 1

SITE 2 (SMALL) - TYPICAL OPEN-WATER SECTION

NOT SUPPORTED BY DETAILED ENGINEERING ANALYSES.
FOR PRELIMINARY COST ESTIMATING PURPOSES ONLY.

PRIOR TO PLACING MATERIAL ABOVE -15 LWD
ALL MATERIAL BELOW -15 LWD MUST BE PLACED.



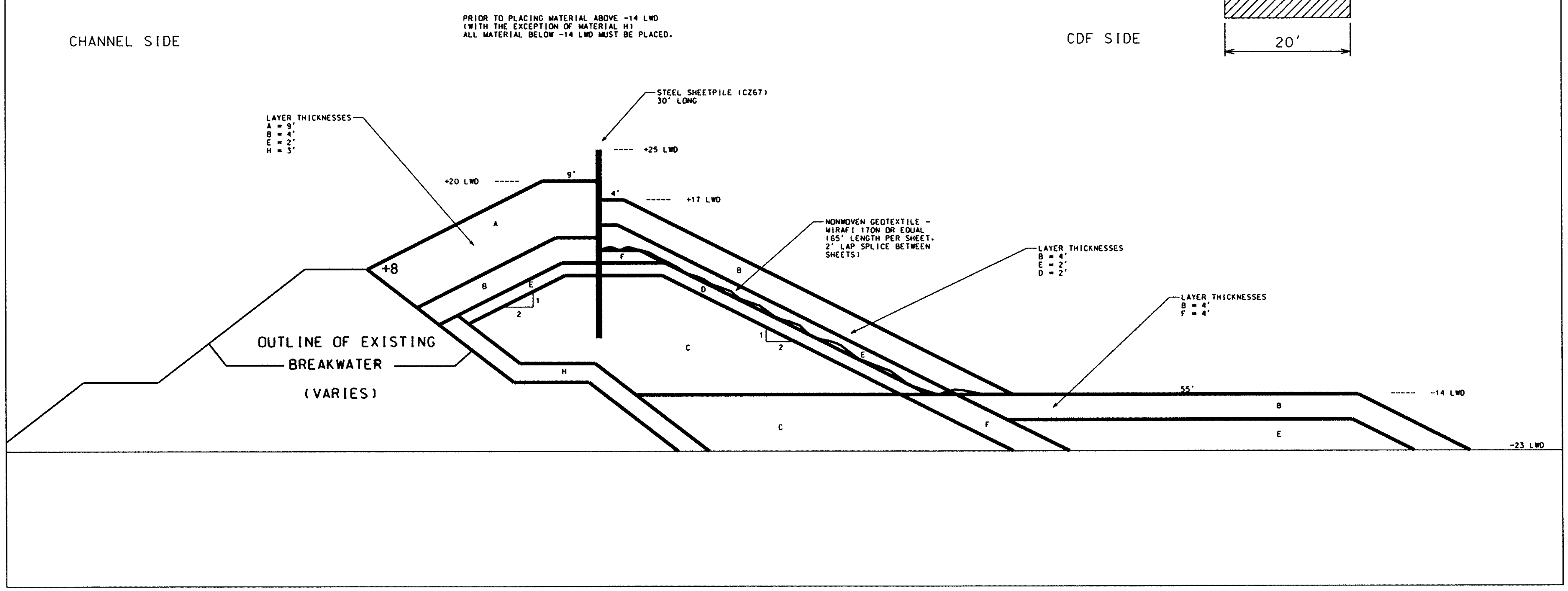
...\Site 2 small.dgn 5/21/2007 9:25:10 AM

Figure 2

SITE 2 (SMALL) - TYPICAL SECTION ALONG ARROWHEAD BREAKWATER

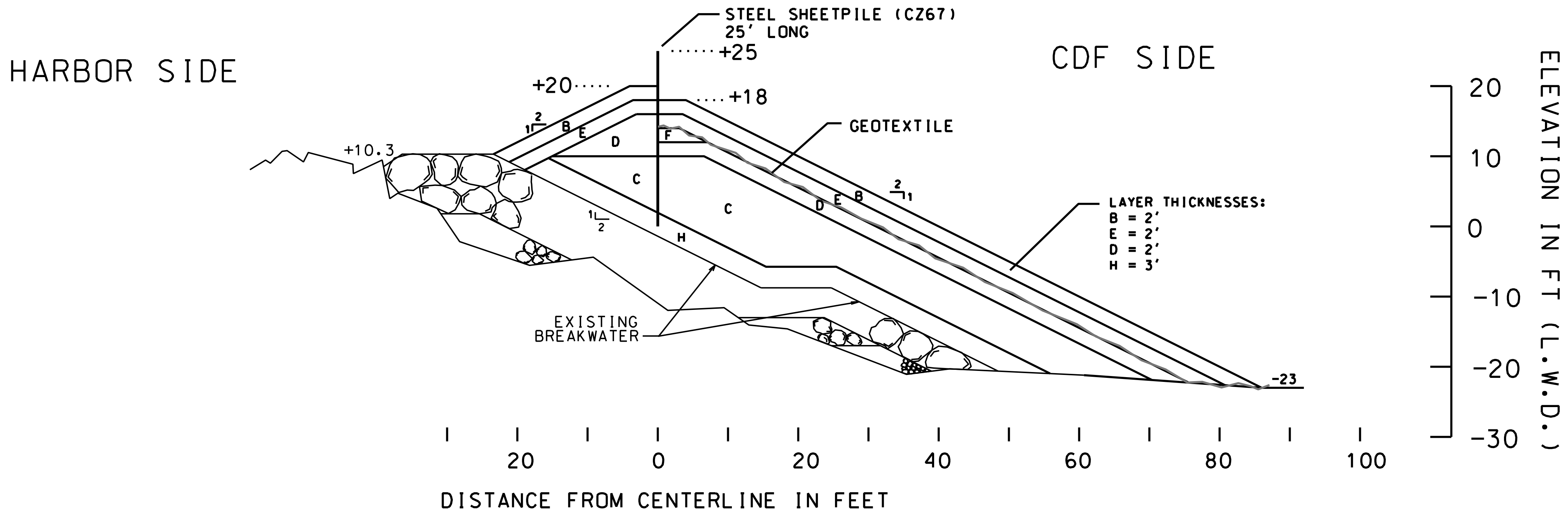
NOT SUPPORTED BY DETAILED ENGINEERING ANALYSES.
FOR PRELIMINARY COST ESTIMATING PURPOSES ONLY.

PRIOR TO PLACING MATERIAL ABOVE -14 LWD
(WITH THE EXCEPTION OF MATERIAL H)
ALL MATERIAL BELOW -14 LWD MUST BE PLACED.

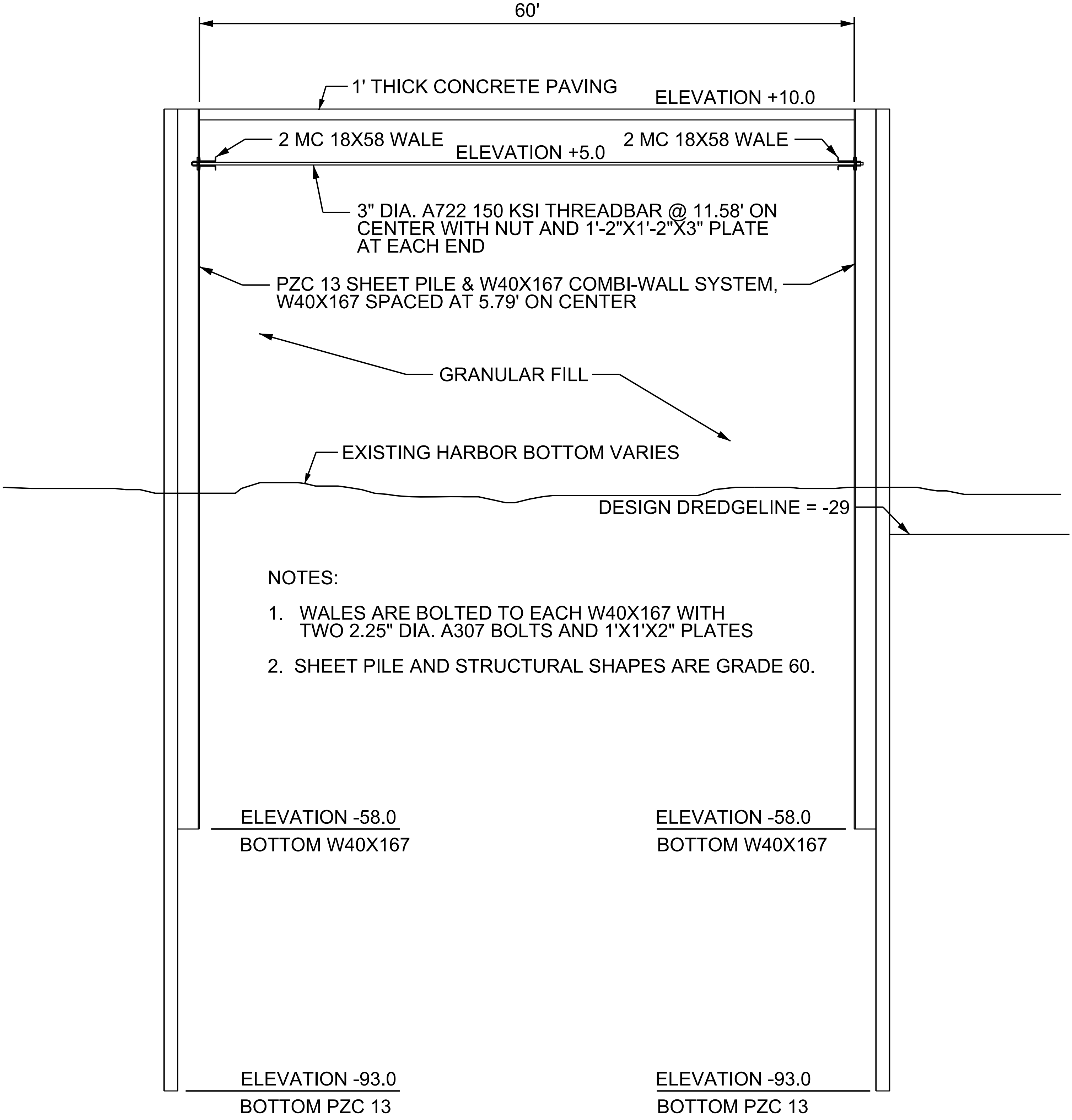


...\Site 2 small arrowhead.dgn 5/21/2007 9:27:55 AM

Figure 4



SITE 3A, CELL 2, TYPICAL SECTION ALONG EAST BREAKWATER
SECTION C-C



NOTES:

1. WALES ARE BOLTED TO EACH W40X167 WITH TWO 2.25" DIA. A307 BOLTS AND 1'X1'X2" PLATES
2. SHEET PILE AND STRUCTURAL SHAPES ARE GRADE 60.

SECTION D-D

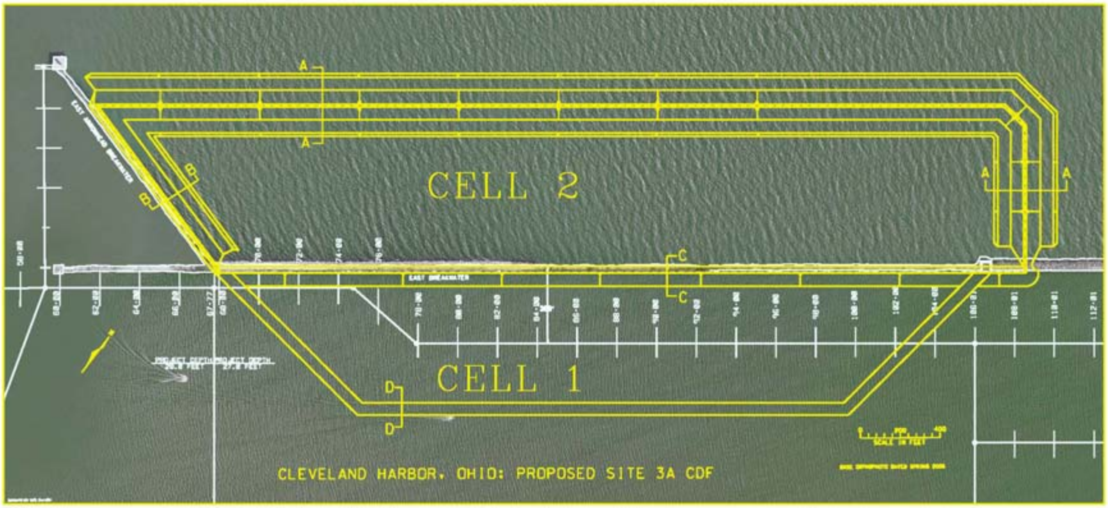
CLEVELAND CDF 2A & 3A (CELL 1)
PROPOSED TYPICAL SECTION
JULY 2008

Tab D
Preliminary Design Alternative Site 2a

Cleveland Site 3A CDF
Preliminary Volume Computations
August 2008

A. Introduction

The purpose of this report is to determine the preliminary capacity for the proposed Confined Disposal Facility (CDF) adjacent to the main entrance to Cleveland Harbor along the East Arrowhead Breakwater (see Insert 1). The outer cell would be bounded by rubble mound breakwaters, with the west and south sides overlaying existing structures. The inner cell is bounded by steel sheet pile cells, with that area planned to be used for port facilities once the CDF is filled.



Insert 1. Location of Proposed CDF

The stone for the outer CDF would be have a crest elevation of about +20 ft Low Water Datum (LWD) and have steel sheet pile driven along its crest with a crest elevation of +25 ft LWD to minimize wave overtopping. The crest elevation of the port facilities was set at +10 ft LWD. The plan and typical cross-sections are presented in Figures 1 through 5.

B. Volume Computations

1. **General Area** – The potential interior volume of the CDF was determined by estimating the volume bounded by the steel sheetpile and subsequently subtracting the volume occupied by the stone structures. The gross volume was determined by generating a digital terrain model (DTM) for the existing bottom, as depicted by a current NOAA chart and channel sounding within the harbor obtained in 2007, and the top elevation of the CDF at +10 ft LWD for Cell 1 or +20 ft LWD for Cell 2. Subtracting these two DTMs resulted in the gross volume within that area. The volume was also determined with the top of the dredged material at one-foot and two-feet below these elevations.

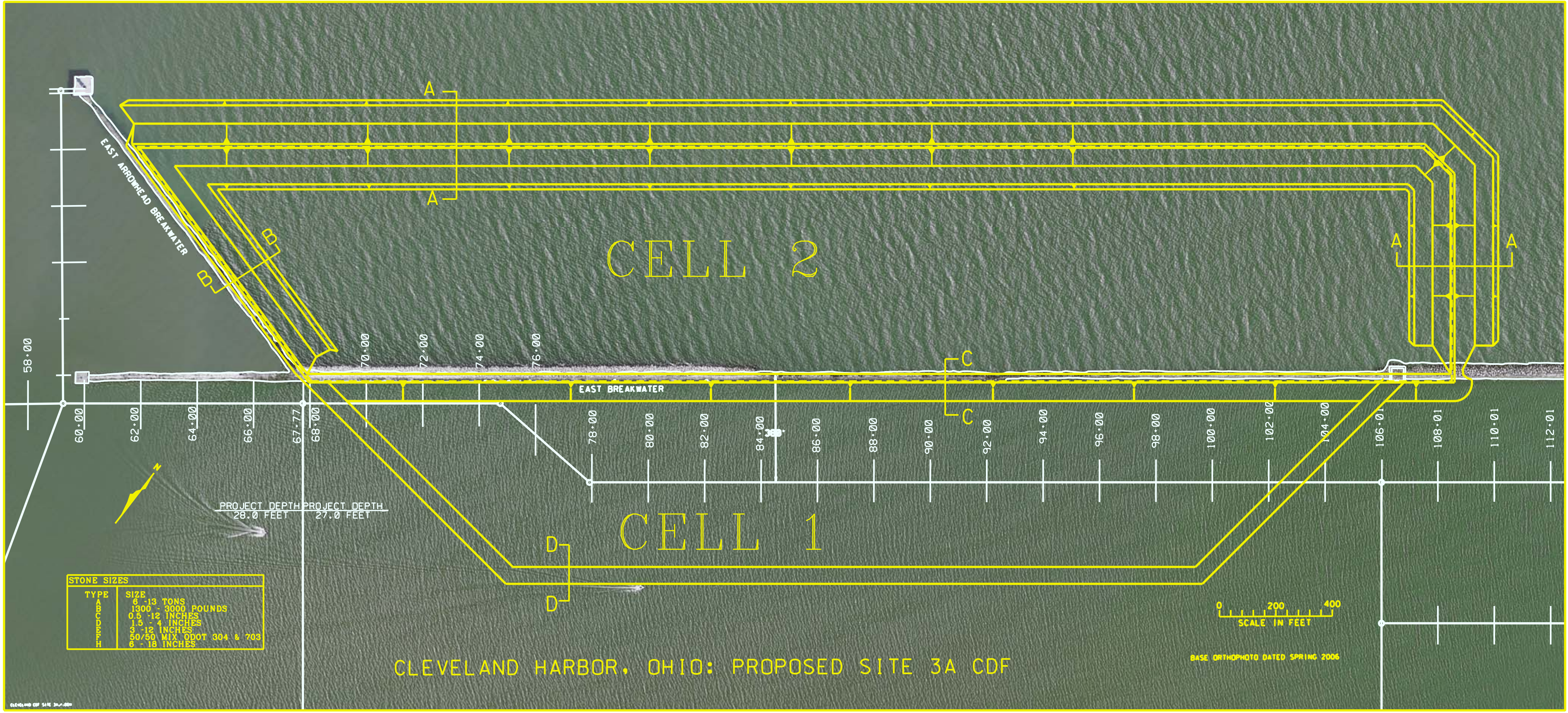
2. **Deductions for Stone Breakwaters -** The volume occupied by the stone structures was based upon the typical section outlines presented on Figures 2-5. The area inward of the sheetpile multiplied by its respective length resulted in the volume.
3. **Total –** Table 1 presents the gross volume within the sheetpile boundary and the reductions due to the stone dikes. Volumes were determined for the top of the dredge material at 0-, 1-, and 2-feet below the CDF crest elevation of the top elevation of the CDF at +10 ft LWD for Cell 1 or +20 ft LWD for Cell 2. The time to reach that capacity was determined by assuming a fill rate of 338,220 cubic yards per year.
4.

Table 1. Cleveland Site 3A CDF Capacity

CELL	FILL ELEVATION – FEET LWD	CAPACITY – CUBIC YARDS	CAPACITY - YEARS
1	+10	1,799,540	5.3
	+9	1,728,822	5.1
	+8	1,658,622	4.9
2	+20	4,654,111	13.8
	+19	4,529,846	13.4
	+18	4,406,020	13.0

C. Conclusion

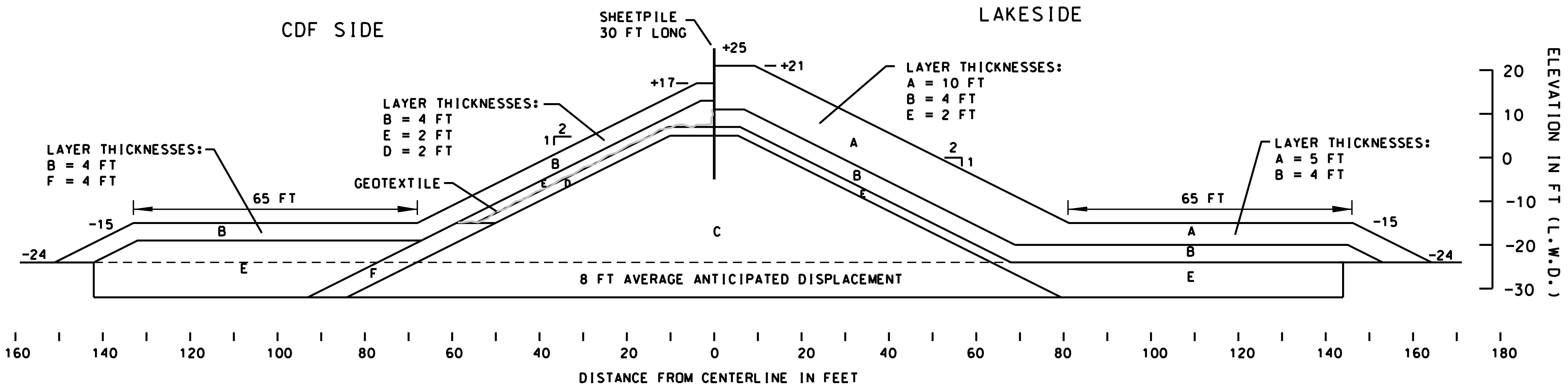
Based upon the aforementioned analysis which used preliminary cross-sections and bottom elevations obtained from a nautical chart and inner harbor channel soundings obtained in 2007, it is estimated that the proposed cells would have a capacity of approximately 4.9 - 5.3 and 13.0 to 13.8 years for Cells 1 and 2, respectively. The maximum capacity of the entire project would be approximately 19.1 years.



STONE SIZES

TYPE	SIZE
A	6 -13 TONS
B	1300 - 3000 POUNDS
C	0.5 -12 INCHES
D	1.5 - 4 INCHES
E	3 -12 INCHES
F	50/50 MIX ODOT 304 & 703
H	6 - 18 INCHES

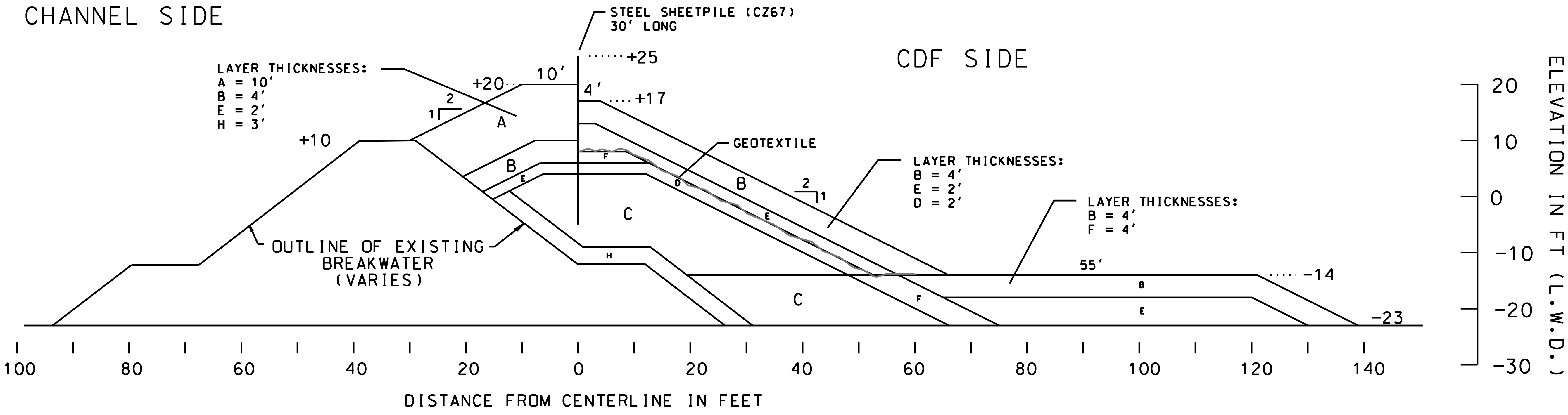
FIGURE 1



SITE 3A, CELL 2, NORTH AND EAST LEG: TYPICAL SECTION AT -24 FT LWD BOTTOM ELEVATION

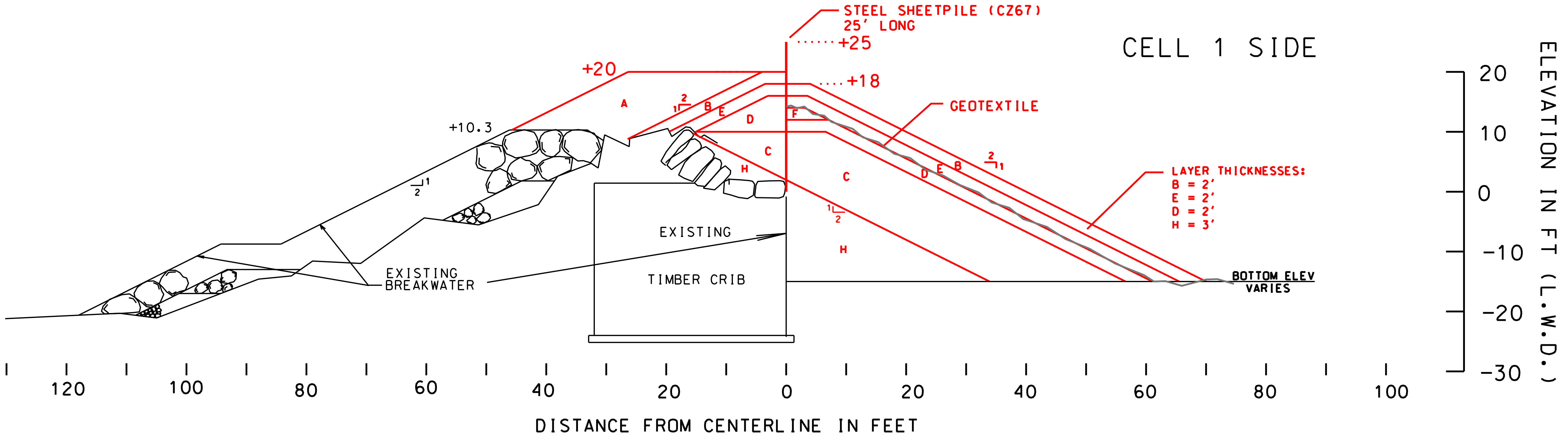
SECTION A-A

FIGURE 2



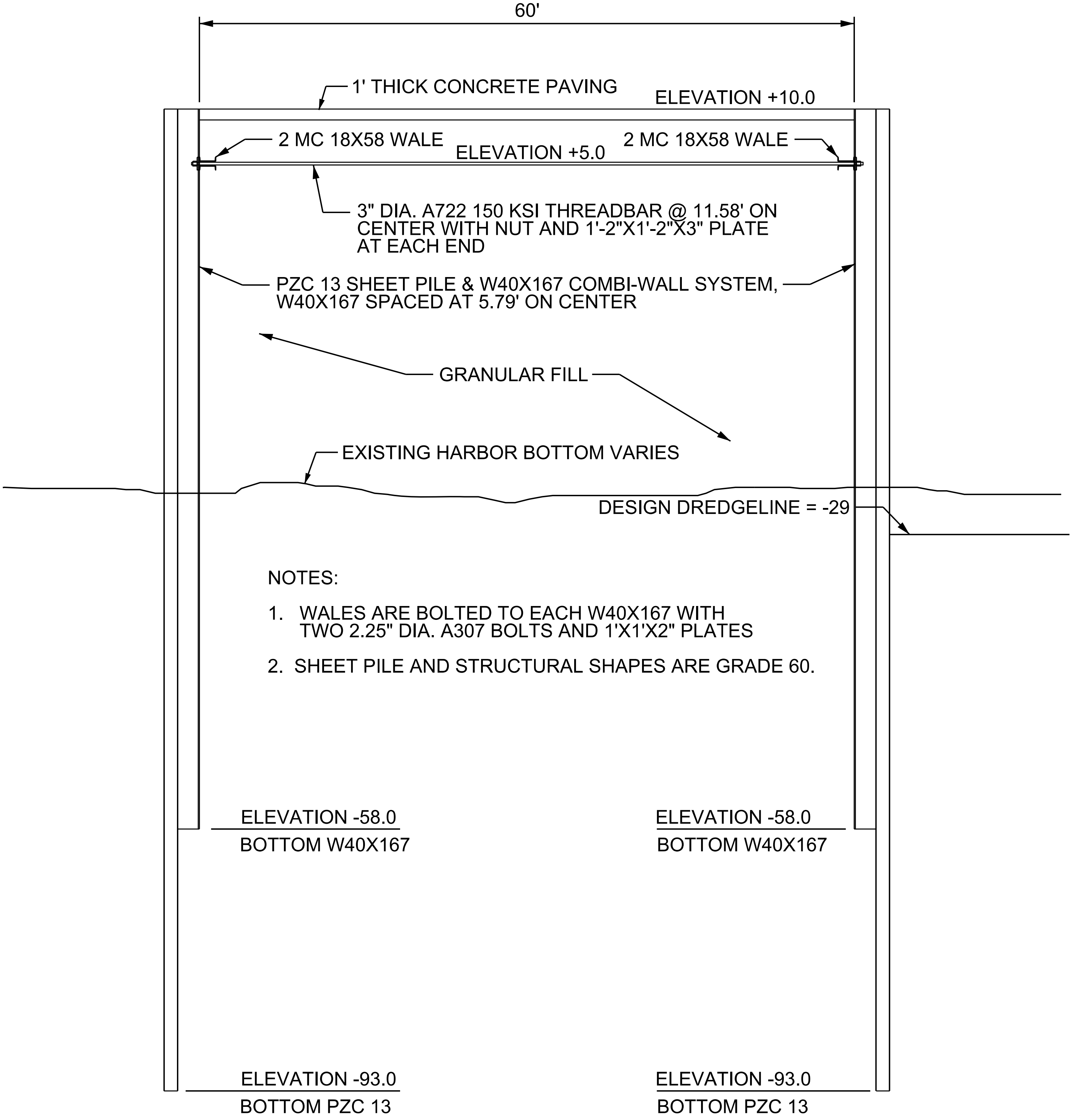
SITE 3A, CELL 2, TYPICAL SECTION ALONG EAST ARROWHEAD BREAKWATER
SECTION B-B

FIGURE 3



SITE 3A, CELL 1, TYPICAL SECTION ALONG EAST BREAKWATER
SECTION C-C

FIGURE 4



NOTES:

1. WALES ARE BOLTED TO EACH W40X167 WITH TWO 2.25" DIA. A307 BOLTS AND 1'X1'X2" PLATES
2. SHEET PILE AND STRUCTURAL SHAPES ARE GRADE 60.

SECTION D-D

CLEVELAND CDF 2A & 3A (CELL 1)
PROPOSED TYPICAL SECTION
JULY 2008

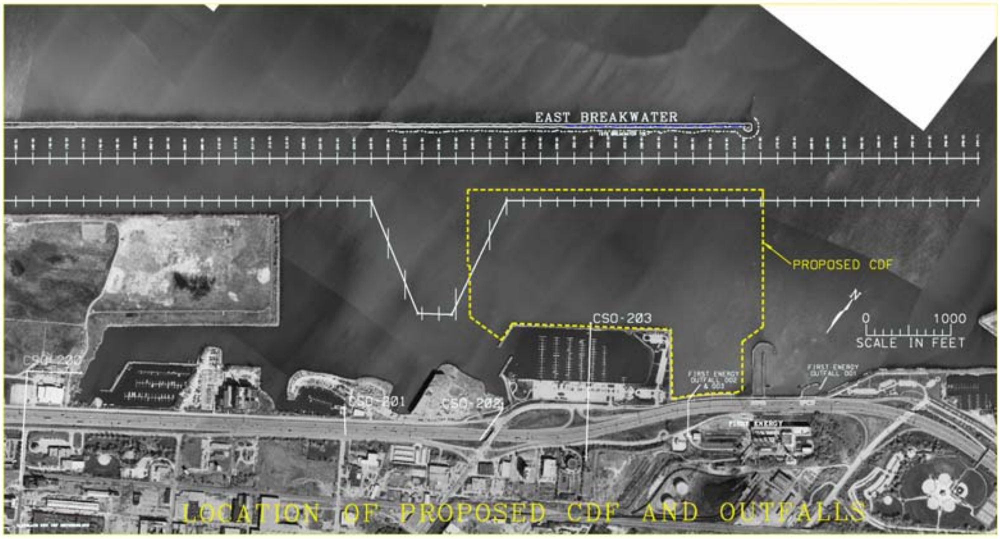
FIGURE 5

Tab E
Preliminary Design Alternative Site East 55th Street

Cleveland East 55th Street CDF
Preliminary Volume Computations

A. Introduction

The purpose of this report is to determine the preliminary capacity for the proposed Confined Disposal Facility (CDF) within Cleveland Harbor at East 55th Street (see Insert 1). Cost constraints require that the CDF be constructed in three phases, with the area is planned to be used for port facilities once the CDF is filled.



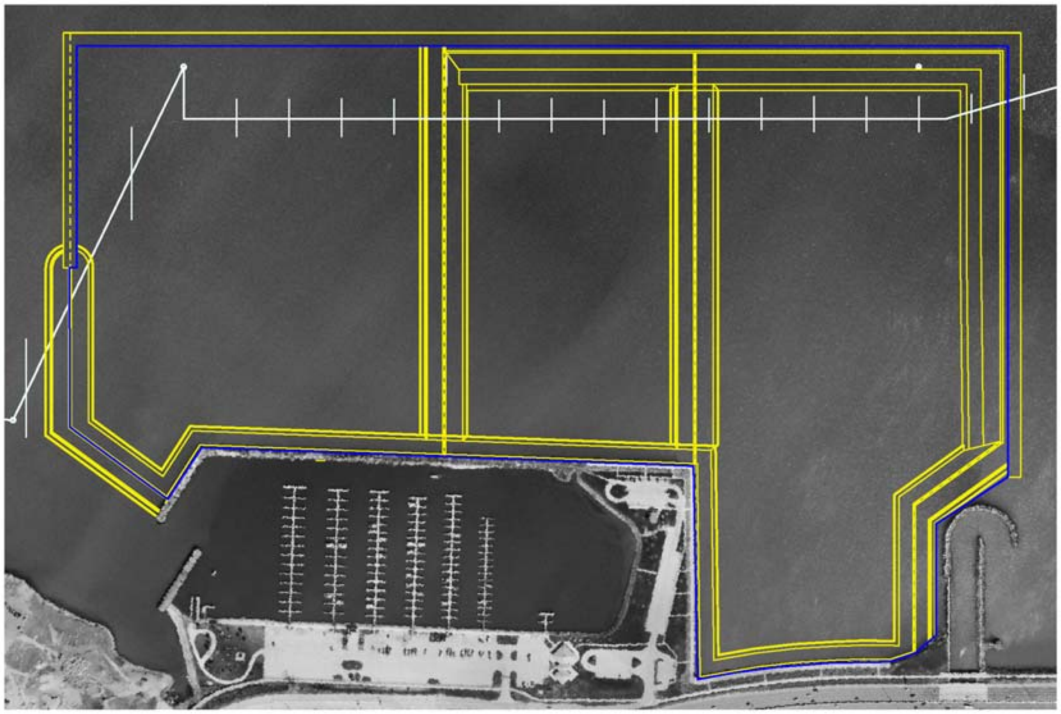
Insert 1. Location of Proposed CDF

The CDF would be bounded along the north, the majority of the east and a portion of the west side by vertical steel sheet pile cells, with the remaining sides composed of sloping stone. While it is expected that the East Breakwater will be extended in the future to provide wave protection for the port facilities, the present harbor configuration will be used for this investigation. The required crest elevation of the port facilities is 580 ft International Great Lakes Datum (IGLD 1985), which is equivalent to +10.8 ft Low Water Datum (LWD). This will be the assumed elevation for the steel cells and west side. However, to minimize overtopping, stone will be placed along the interior, adjacent to the steel cells along a portion of the north and east side at +20 ft LWD. Typical stone cross-sections for the existing CDF at Dike 10b and the proposed Site 2 were assumed applicable to this site. It is assumed the phased construction would progress east to west. The plan and typical cross-sections are presented in Figures 1 and 2.

B. Volume Computations

1. **General Area** – The potential interior volume of the CDF was determined by estimating the volume within the blue outline and subsequently subtracting the volume occupied by the stone structures. The gross volume was determined by generating a digital terrain model (DTM) for the existing bottom, as depicted by a current NOAA chart and the top elevation of the CDF at 580 feet International

Great Lakes Datum (IGLD 1985). Subtracting these two DTMs resulted in the gross volume within the blue area. The volume was also determined with the top of the dredged material at one-foot and two-feet below the dike crest.



Insert 2. Outline of "Blue Area"

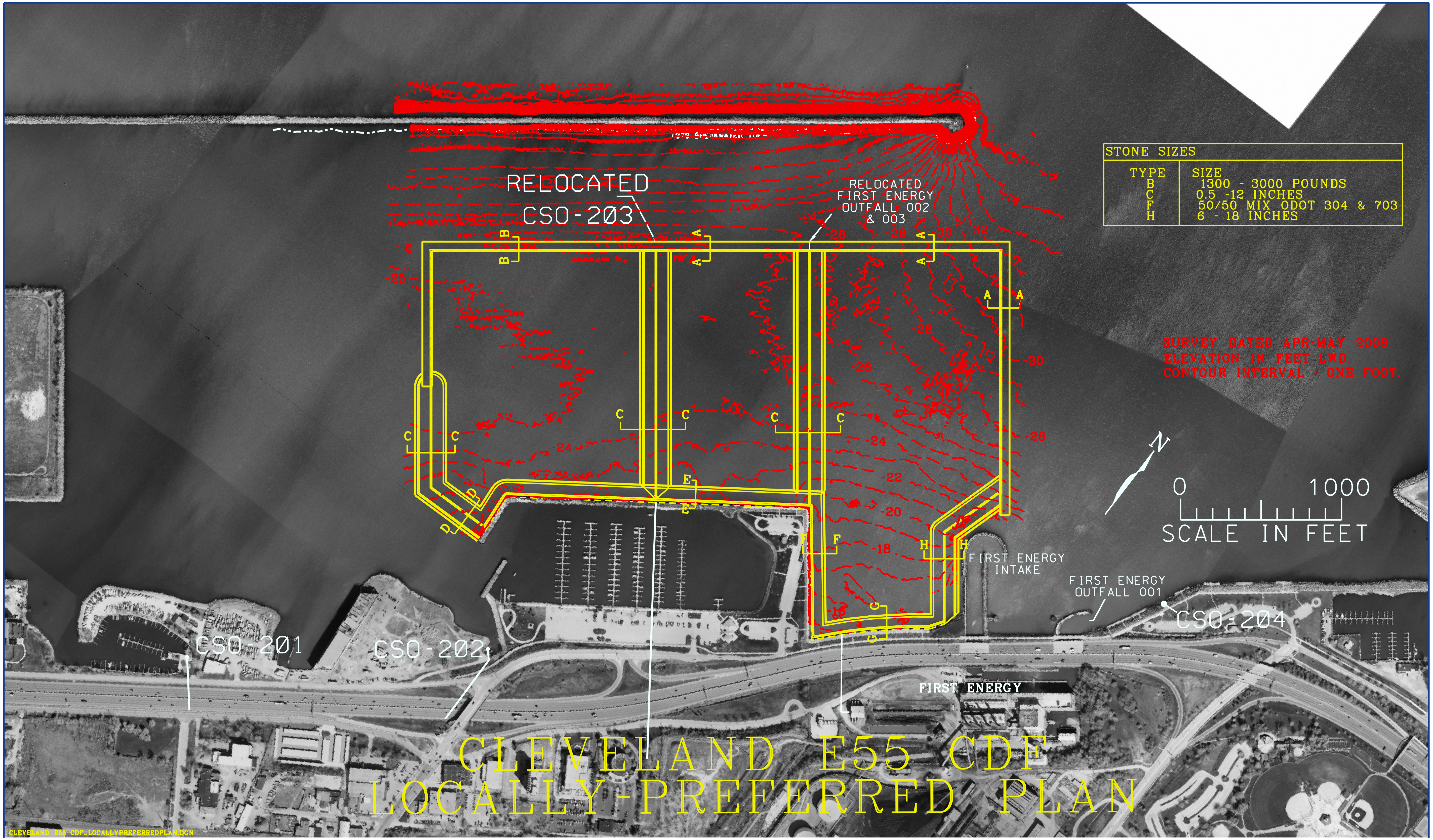
2. **Deductions for Stone Breakwaters -** The volume occupied by the stone structures was based upon the typical section outlines presented on Figure 2. The area inward of the blue box multiplied by its respective length resulted in the volume.
3. **Total –** Table 1 presents the gross volume within the blue outline and the reductions due to the stone dikes. Volumes were determined for the top of the dredge material at 0-, 1-, and 2-feet below the CDF crest elevation of 580 feet IGLD (1985). The time to reach that capacity was determined by assuming a fill rate of 338,220 cubic yards per year.

C. Conclusion

Based upon the aforementioned analysis which used preliminary cross-sections and bottom elevations obtained from a nautical chart, it is estimated that the proposed CDF will have a capacity of approximately 20 years.

Table 1. Cleveland E55th Street CDF Capacity (Configuration 2)

Fill Elevation in Feet IGLD '85	580	579	578
Volume in Blue Box – Cubic Yards	7997142	7760750	7524358
Less West BKW stone @-24'LWD – Cubic Yards	31420	31296	31128
Less West BKW stone @-18'LWD – Cubic Yards	16703	16610	16484
Less Stone along marina & Highway – Cubic Yards	155820	155451	152809
Less East BKW stone @ -18 ft LWD – Cubic Yards	71468	69778	68265
Less East BKW stone Transition – Cubic Yards	70564	68771	67037
Less East Side	212006	209372	206624
Less North BKW stone – Cubic Yards	277561	274111	270515
Single CDF Volume CY (1) – Cubic Yards	7161600	6935361	6711496
Cross Dikes	306778	305467	303719
Final Volume (2) Cubic Yards – Cubic Yards	6854822	6629894	6407777
Capacity in Number of Years (3)	20.3	19.6	18.9

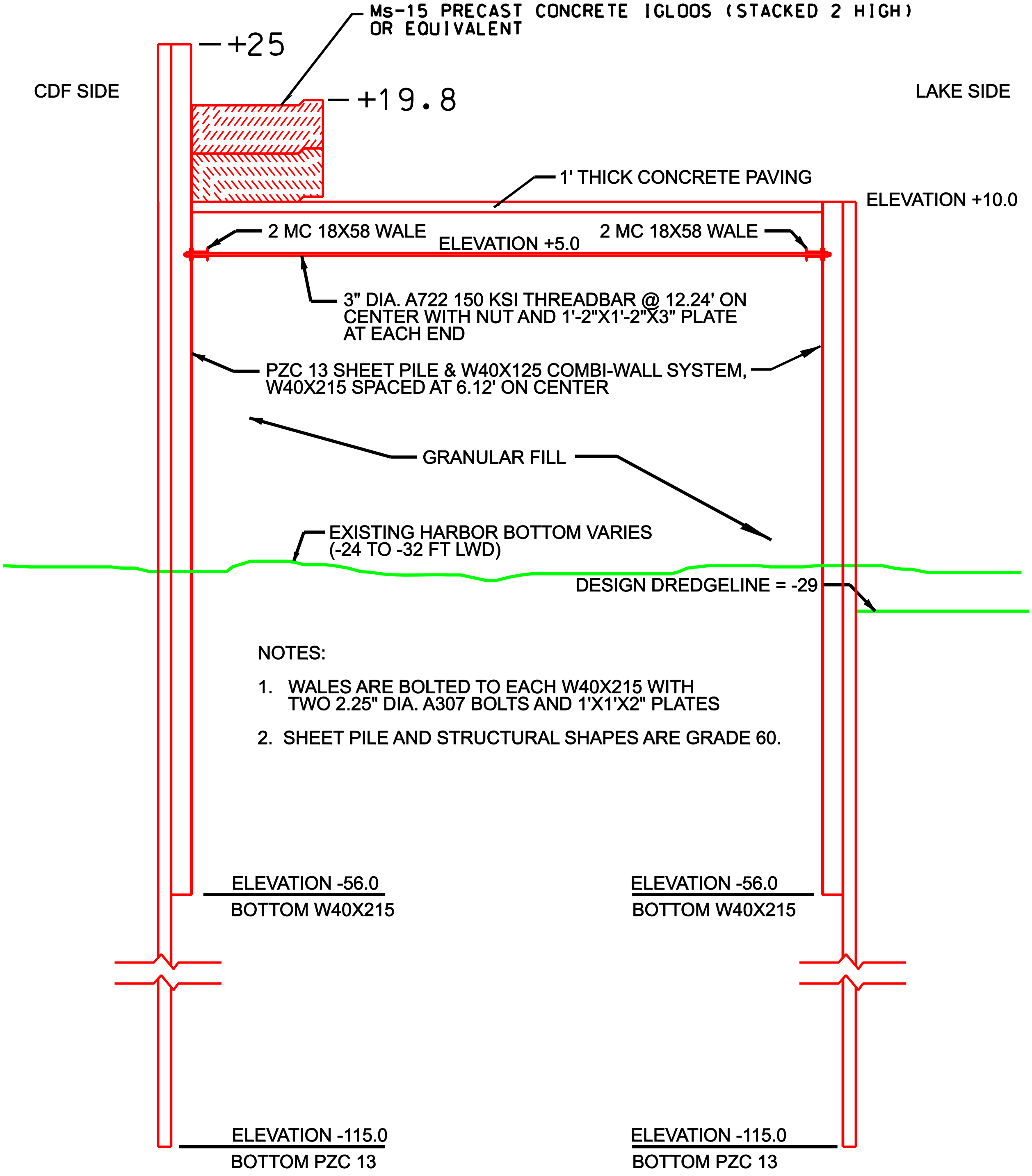


CLEVELAND E55 CDF LOCALLY-PREFERRED PLAN

TYPE	SIZE
B	1300 - 3000 POUNDS
C	0.5 -12 INCHES
F	50/50 MIX ODOT 304 & 703
H	6 - 18 INCHES

SURVEY DATED APR-MAY 2008
ELEVATION IN FEET LWD.
CONTOUR INTERVAL - ONE FOOT.

CLEVELAND E55 CDF_LOCALLYPREFERREDPLAN.DGN



NOTES:

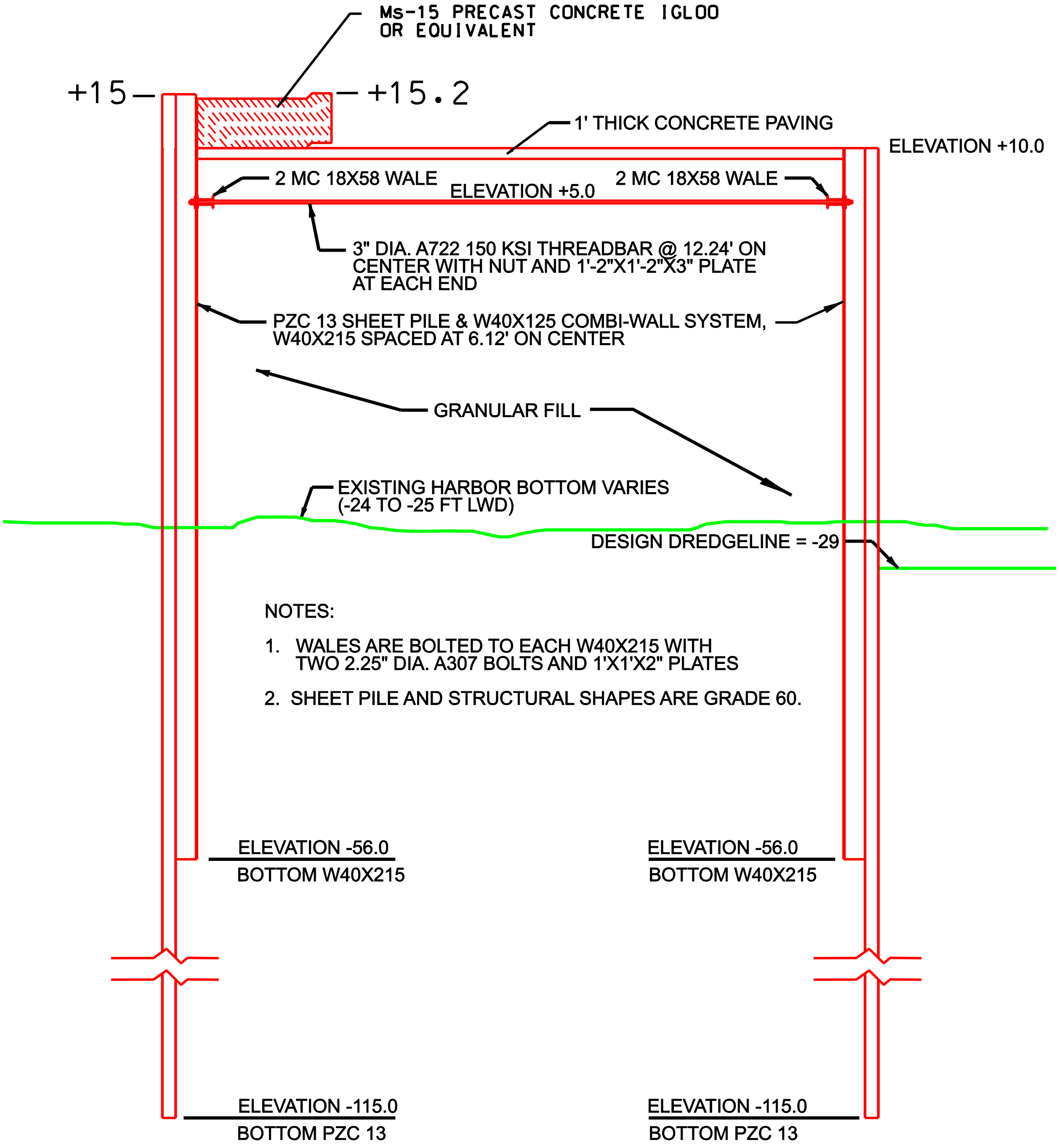
1. WALES ARE BOLTED TO EACH W40X215 WITH TWO 2.25" DIA. A307 BOLTS AND 1'X1'X2" PLATES
2. SHEET PILE AND STRUCTURAL SHAPES ARE GRADE 60.

CLEVELAND E55TH STREET CDF, LOCALLY-PREFERRED PLAN

TYPICAL SECTION A-A

0 10
SCALE - FT

JULY 2008



NOTES:

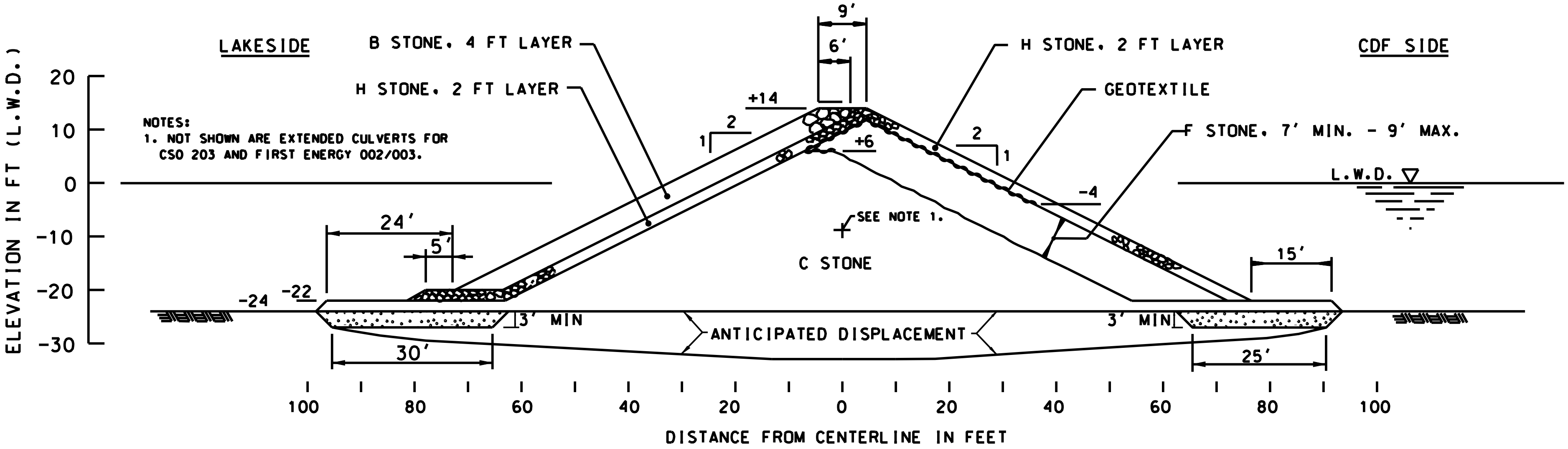
1. WALES ARE BOLTED TO EACH W40X215 WITH TWO 2.25" DIA. A307 BOLTS AND 1'X1'X2" PLATES
2. SHEET PILE AND STRUCTURAL SHAPES ARE GRADE 60.

CLEVELAND E55TH STREET CDF, LOCALLY-PREFERRED PLAN

TYPICAL SECTION B-B

0 10
SCALE - FT

JULY 2008

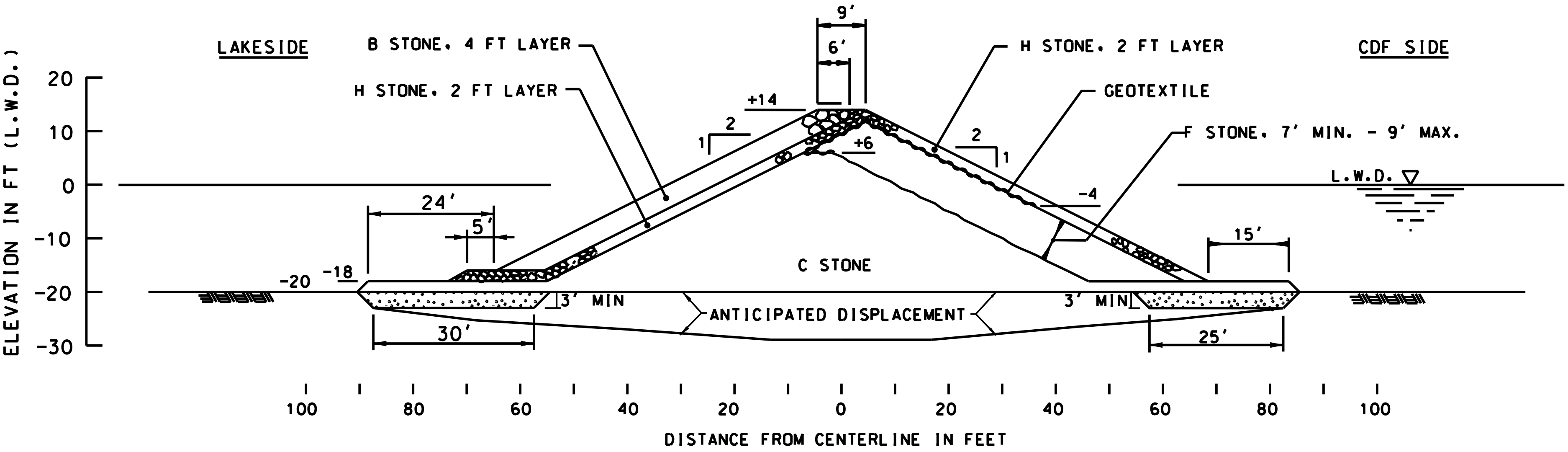


NOTES:
1. NOT SHOWN ARE EXTENDED CULVERTS FOR CSO 203 AND FIRST ENERGY 002/003.

CLEVELAND E55TH STREET CDF, LOCALLY-PREFERRED PLAN

SECTION C-C

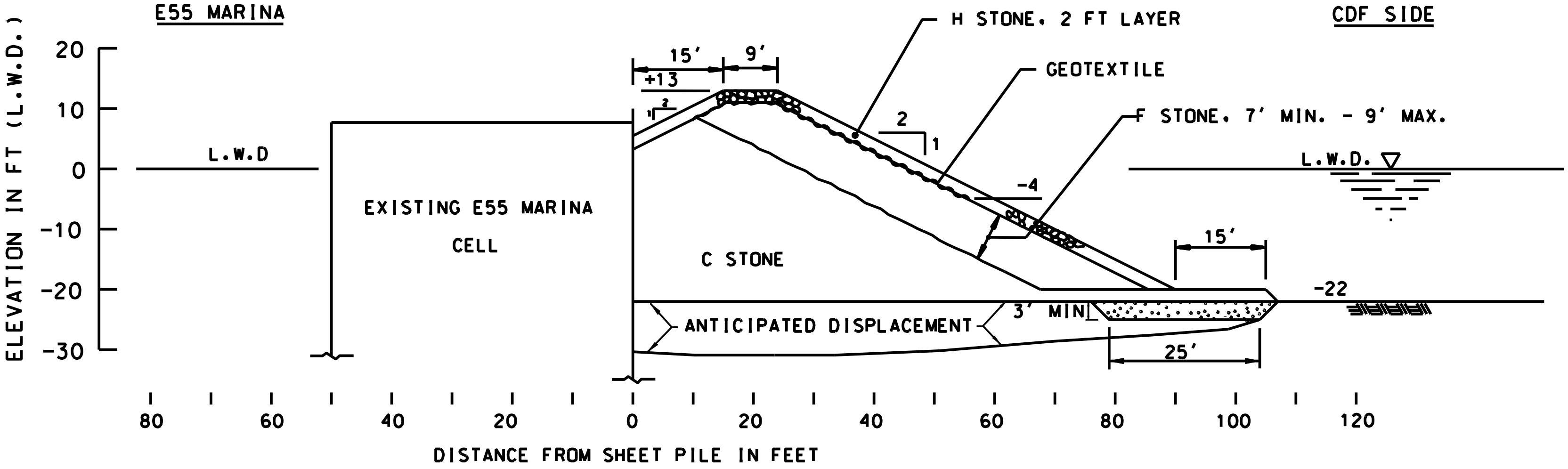
JULY 2008



CLEVELAND E55TH STREET CDF, LOCALLY-PREFERRED PLAN

SECTION D-D

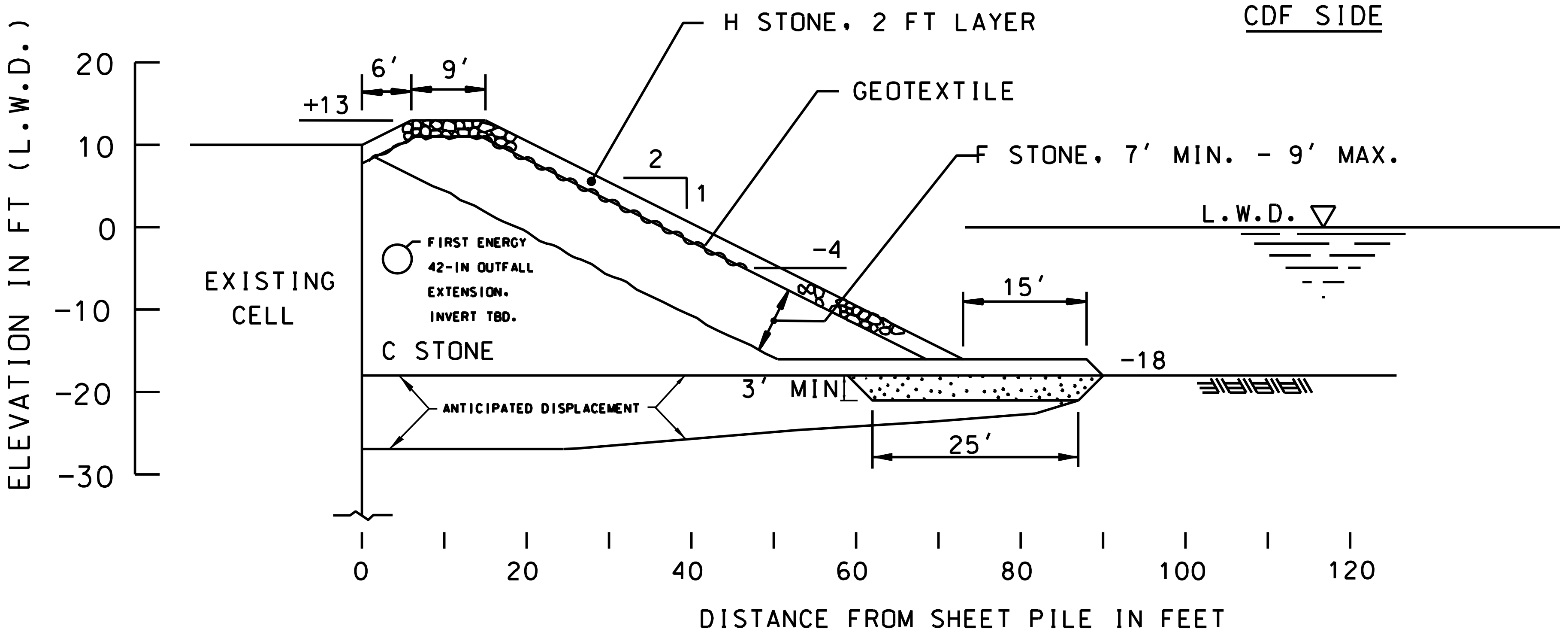
JULY 2008



CLEVELAND E55TH STREET CDF, LOCALLY-PREFERRED PLAN

SECTION E-E

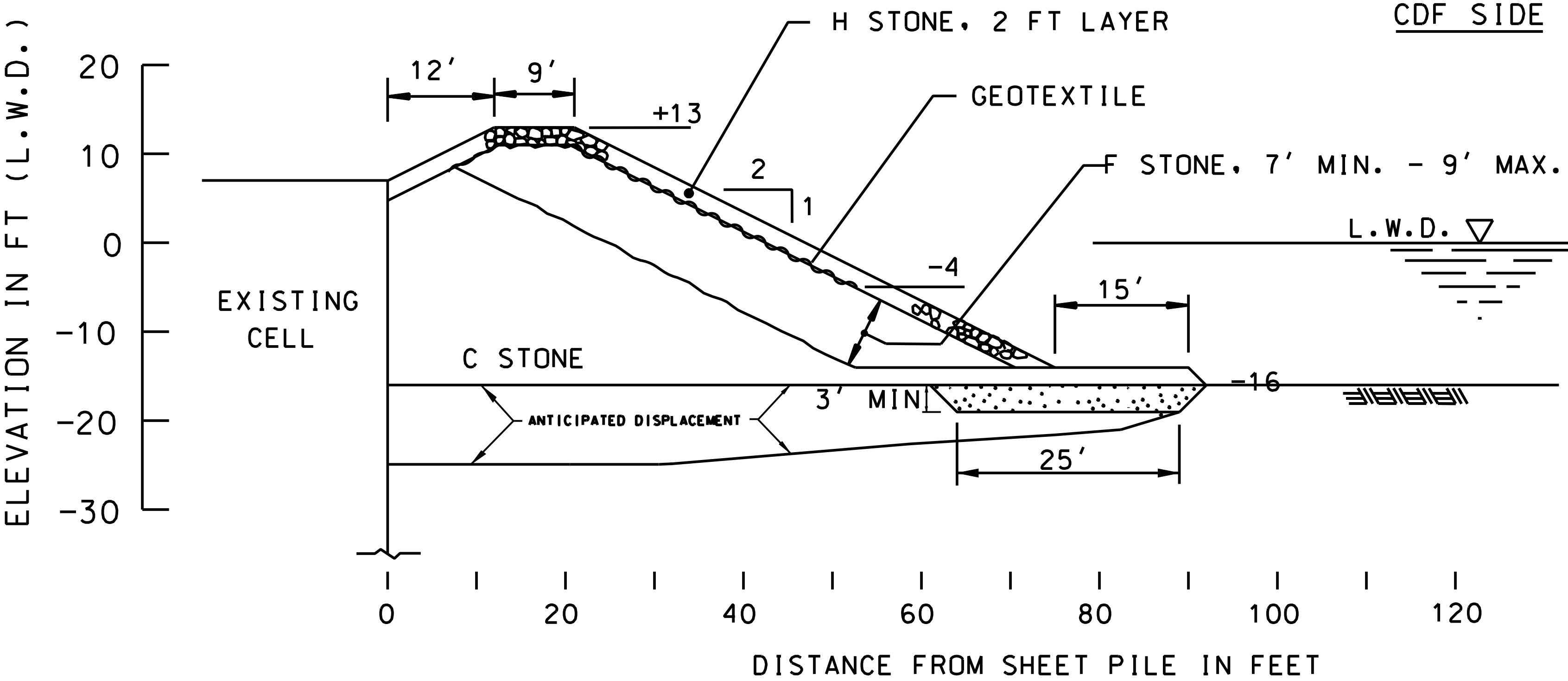
JULY 2008



CLEVELAND E55TH STREET CDF, LOCALLY-PREFERRED PLAN

SECTION F-F

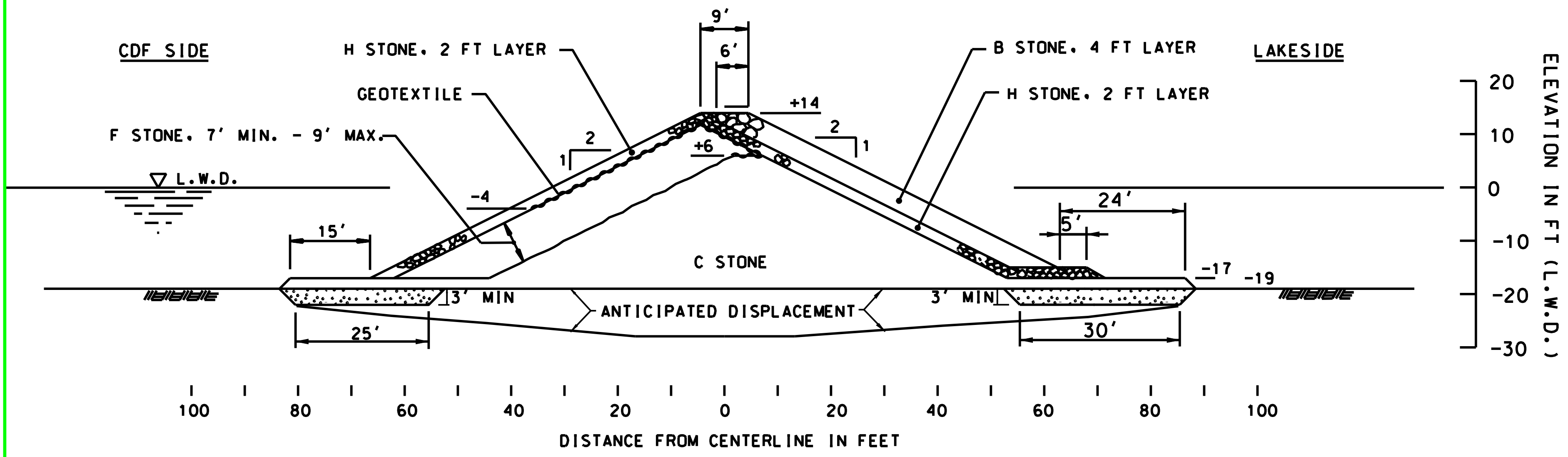
JULY 2008



CLEVELAND E55TH STREET CDF, LOCALLY-PREFERRED PLAN

SECTION G-G

JULY 2008



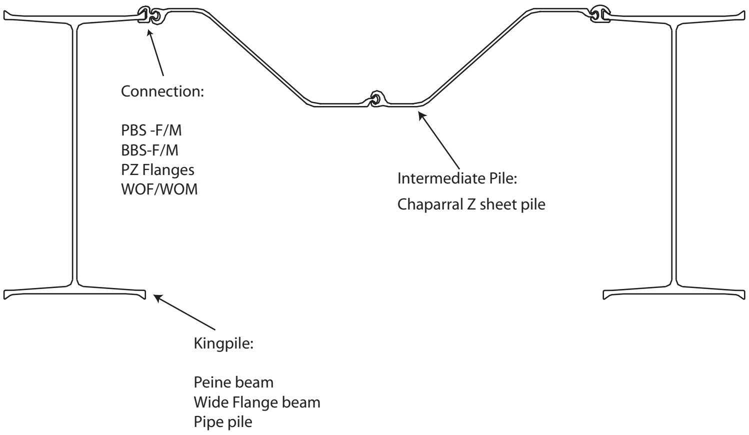
CLEVELAND E55TH STREET CDF, LOCALLY-PREFERRED PLAN

SECTION H-H

JULY 2008

Combi-wall Systems

L.B. Foster is dedicated to offering the most efficient combi-wall system for your needs through utilizing a variety of systems. Using specialized beams from Peine or domestic wide flange beams, extruded connectors from Pile Pro, and PZC sheet pile from Chaparral, L.B. Foster is able to put together the right package. Systems using the Wide Flange Beams and PZC sheet pile are 100% melted and manufactured in U.S.A.



The systems shown represent only a portion of the variations possible. Intermediate sheet pile function as earth retention and for load transfer. The sheet pile is only required to resist active earth pressures down to the zero earth pressure level and may extend below this level as a safety measure. Shortening the lengths of the intermediate sheet pile will reduce the cost of the job and facilitate installation.

Peine system properties shown are with the connectors being supplied loose. Moment of inertia and section modulus can be improved if the connectors are welded on to the beams. This is possible in a variety of combinations. The wide flange beams will have either the connectors or flanges welded on with a full length fillet weld as standard. Please contact us with your project requirements so we can offer a custom solution.

Port of Oakland, Phase 1

Port of Oakland, Phase 2

Conneaut, OH

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www.fosterpiling.com

Combi-wall Systems

Combi-walls are piling walls that are comprised of high modulus structural components interspaced by lighter sheet piles. The high modulus components - known as king piles - can be tubular, box, bearing or other types of fabricated piles.

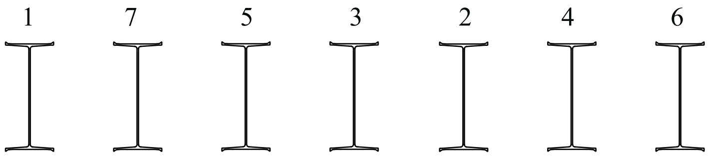
It is essential that a stable, heavy, adequately rigid and straight pile-driving template frame, adapted to suit the length and weight of the pilings, be provided.

The king piles are fixed into position within the template using welded bracket guides which take into account width tolerances.

Driving of the king piles must be carried out with extreme care in order to ensure that they are embedded straight and vertical, or at a prescribed batter, thereby guaranteeing that they are parallel to each other and at the required spacing.

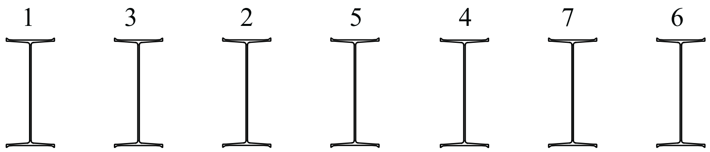
The driving sequence of the king piles must ensure that the pile toe encounters soil uniformly on its total circumference and not just on one side.

This is achieved by driving in the following sequence



(large driving step)

At least, however, the following sequence should be observed:



(small driving step)

In general, all of the king piles should be driven in sequence to full penetration without interruption. Following successful completion of this, the intermediate light piling sections can be set and driven. During the setting and driving operations of the king piles, a constant check (using theodolites) should be made of their alignment in relation to the wall.

When the guide frames have been removed, a final survey should be made to ensure that the deviations in the distance between the king piles are within the acceptable tolerances in order to allow the proper installation of the sheet pile. However, if the deviations are outside the specified or practical tolerances, then either the intermediate piles have to be adjusted or the king piles must be extracted and re-driven.

To overcome difficult driving conditions, it may be possible to use: jetting; excavating inside the king piles; or any other the ground pre-treatment methods normally adopted for sheet piling.

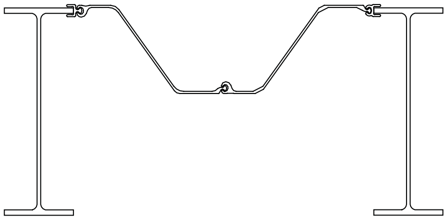
Above text taken from the "NASSPA Best Practices Sheet Piling Installation Guide"

Combi-wall Solution Variations

L.B. Foster is dedicated to offering the most efficient combi-wall system
for your needs through utilizing our vast array of systems

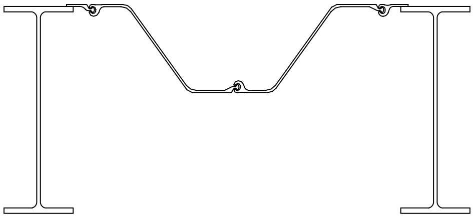
100% Domestic Solutions:

Wide Flange with Extruded Connectors



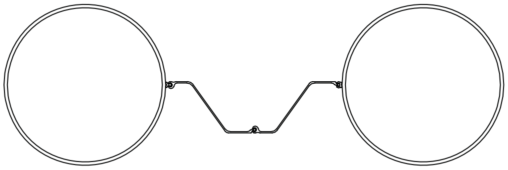
Width Range: 48” - 74”
Section Modulus Range (in^3 / ft): 40-335
Moment of Inertia Range (in^4 / ft): 700-7070

Wide Flange with Z-Profile Flanges



Width Range: 50” - 80”
Section Modulus Range (in^3 / ft): 40-320
Moment of Inertia Range (in^4 / ft): 700-6800

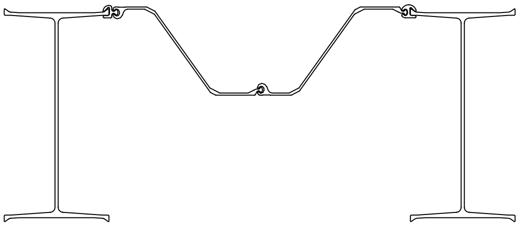
Pipe Pile with Extruded Connectors



The properties are only limited to jobsite
and manufacturing restrictions.

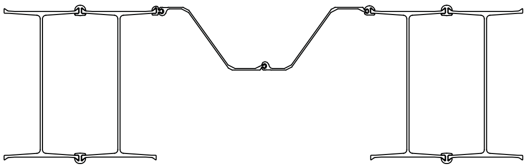
Foreign Solutions:

Single Peine Beam System



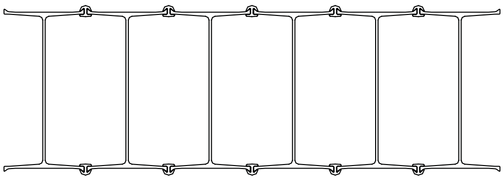
Width Range: 54” - 77”
Section Modulus Range (in^3 / ft): 30-280
Moment of Inertia Range (in^4 / ft): 500 - 6200

Double Peine Beam System



Width Range: 70” - 95”
Section Modulus Range (in^3 / ft): 40 - 435
Moment of Inertia Range (in^4 / ft): 500 - 8800

Box Peine Beam System



Width Range: 16” - 19”
Section Modulus Range (in^3 / ft): 130 - 700
Moment of Inertia Range (in^4 / ft): 1000 - 14600

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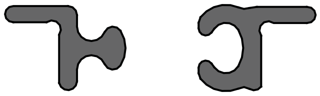
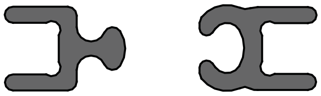
L.B. Foster Combi-wall systems can be supplied with a range of connections. Each connector series offers distinct advantages to assure you have the best system for your project.



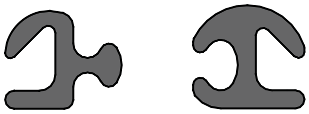
One Leg BBS Connectors:

Universal & in stock - ready for quick orders
Field or shop weld full length to beam



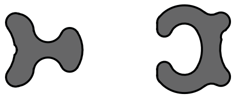
BBS Connectors:

Produced to your job requirements
Field or shop weld full length to beam



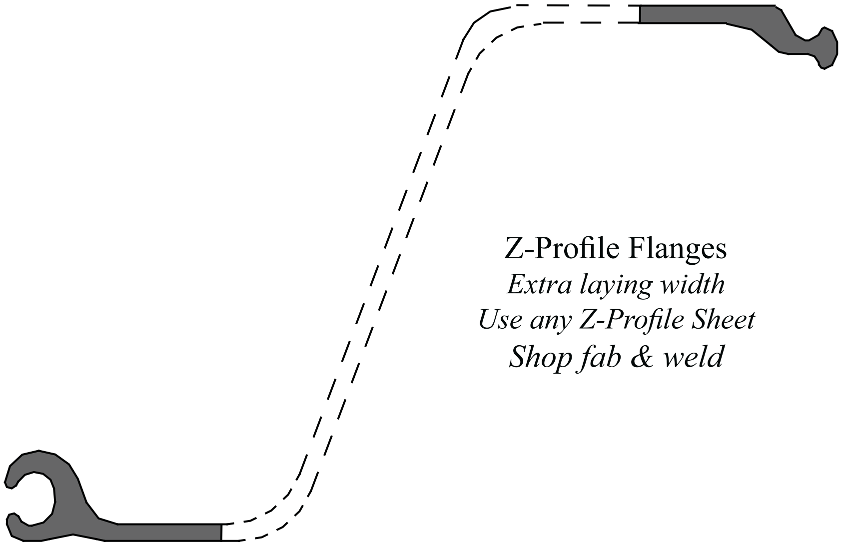
PBS Connectors:

Most flexible system on the market
Simply tack weld to sheet pile in field



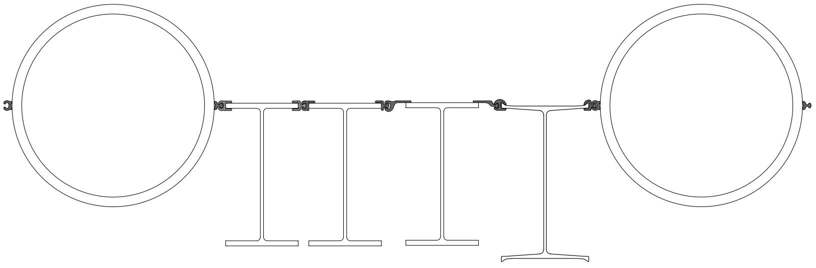
WOM / WOF Connectors:

Used in weight efficient pipe combi-walls
Field or shop weld full length to pipe



Z-Profile Flanges

Extra laying width
Use any Z-Profile Sheet
Shop fab & weld



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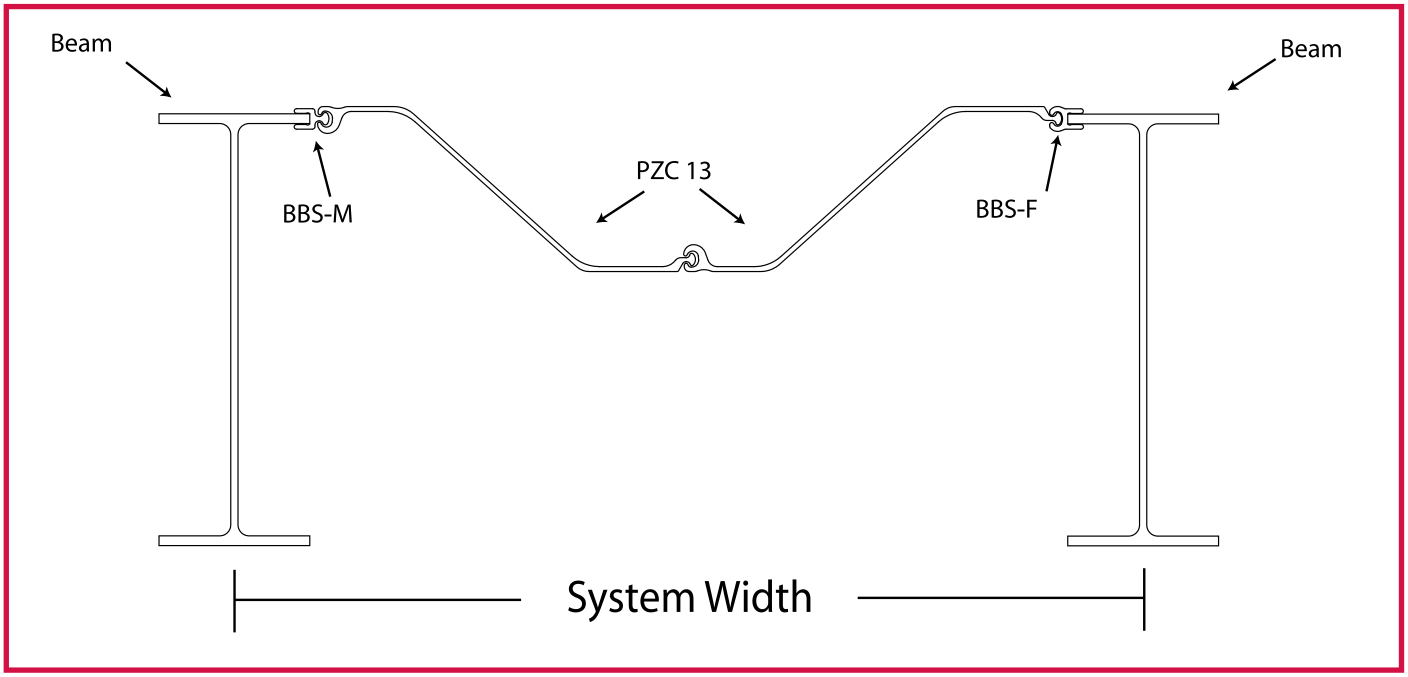
PZC™ 13 Combi-wall Solution



Dimensions and Properties

Beam	System Width	Section Modulus	Moment of Inertia	Weight in Pounds lb / ft^2		
	in.	in^3 / ft	in^4 / ft	100%	80%	60%
W33 x 118	69.18	72.5	1330	40.7	36.7	32.6
W33 x 130	69.21	80.5	1474	42.8	38.7	34.7
W36 x 135	69.65	85.9	1683	43.4	39.4	35.3
W40 x 149	69.51	98.8	2065	45.9	41.8	37.8
W40 x 167	69.51	113.9	2385	49.0	45.0	40.9
W40 x 183	69.51	127.7	2683	51.7	47.7	43.7
W40 x 199	73.45	135.1	2800	51.6	47.8	44.0
W40 x 215	73.45	149.0	3098	54.2	50.4	46.6
W40 x 249	73.45	170.9	3560	59.8	55.9	52.1
W40 x 277	73.53	189.2	3952	64.3	60.4	56.6
W40 x 297	73.53	199.4	4167	67.5	63.7	59.9
W40 x 321	73.61	213.6	4474	71.4	67.6	63.7
W40 x 372	73.76	246.4	5202	79.5	75.7	71.9

% of sheet pile length to beam length

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Micro Piles
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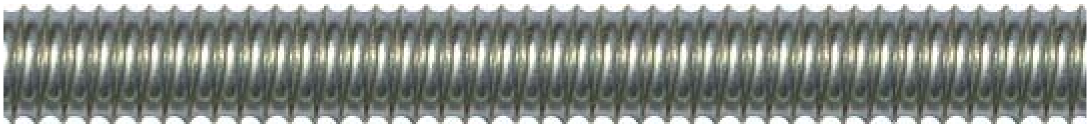
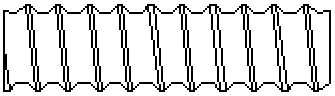
WILLIAMS CONCRETE ACCESSORIES DIVISION

150 KSI All-Thread-Bar

Threaded Bar Types | 150 KSI Information | 150 KSI Accessories | Case Histories | Corrosion Protection



Structural Properties	
Yield Stress	**Ultimate Stress**
127.7 KSI (880.5 Mpa)	150 KSI (1034.3 Mpa)
Elongation in 20 bar diameters	**Reduction of Area**
4%	20%



Unique Thread Form

R71 150 KSI All-Thread-Bar - ASTM A722

Nominal Bar Diameter	Minimum Net Area Thru Threads	Minimum Ultimate Strength	Minimum Yield Strength	Nominal Weight	Approx. Thread Major Dia.	Part Number
1" (25 mm)	0.85 in^2 (549 mm^2)	128 kips (567 kN)	102 kips (454 kN)	3.09 lbs./ft. (4.6 Kg/M)	1-1/8" (28.6 mm)	R71-08
1-1/4" (32 mm)	1.25 in^2 (807 mm^2)	188 kips (834 kN)	150 kips (667 kN)	4.51 lbs./ft. (6.71 Kg/M)	1-7/16" (36.5 mm)	R71-10
1-3/8" (36 mm)	1.58 in^2 (1019 mm^2)	237 kips (1054 kN)	190 kips (843 kN)	5.71 lbs./ft. (8.50 Kg/M)	1-9/16" (39.7 mm)	R71-11
1-3/4" (45 mm)	2.60 in^2 (1664 mm^2)	400 kips (1779 kN)	320 kips (1423 kN)	9.06 lbs./ft. (13.5 Kg/M)	2" (50.8 mm)	R71-14
2-1/2" (65 mm)	5.19 in^2 (3350 mm^2)	778 kips (3457 kN)	622 kips (2766 kN)	18.2 lbs./ft. (27.1 Kg/M)	2-3/4" (69.9 mm)	R71-20
** 3" (75 mm)	6.46 in^2 (4169 mm^2)	969 kips (4311 kN)	775 kips (3448 kN)	22.3 lbs./ft. (32.7 Kg/M)	3-3/64" (78.2 mm)	R71-24

Effective cross sectional areas shown are as required by ASTM A-722-98. Actual areas may exceed these values.
ACI 355.1R section 3.2.5.1 indicates an ultimate strength in shear has a range of .6 to .7 of the ultimate tensile strength. Designers should provide adequate safety factors for safe shear strengths based on the condition of use.
Per PTI Recommendations for Prestressed Rock and Soil Anchors section 6.6, anchors should be designed so that:
- The design load is not more than 60% of the specified minimum tensile strength of the prestressing steel.
- The lock-off load should not exceed 70% of the specified minimum tensile strength of the prestressing steel.
- The maximum test load should not exceed 80% of the specified minimum tensile strength of the prestressing steel.

** The 3" diameter bar is not covered under ASTM A722.

Properties

Williams 150 KSI All-Thread-Bars are manufactured in strict compliance with ASTM A-722-98 and AASHTO M275 Highway Specifications. The prestressing steel is high in strength yet ductile enough to exceed the specified elongation and reduction of area requirement. Selected heats can also pass the 135° supplemental bend test when required. Testing has shown Williams 150 KSI All-Thread-Bars to meet or exceed post tensioning bar and rock anchoring criteria as set by the Post Tensioning Institute including dynamic test requirements beyond 500,000 cycles of loading.

Williams 360° continuous thread deformation pattern has the ideal relative rib area configuration to provide excellent bond strength capability to grout or concrete, far better than traditional reinforcing deformation patterns.

Threads

All-Thread-Bars are cold rolled to close tolerances under continuous monitoring procedures for quality control. Threads for Williams All-Thread Bar are specially designed with a rugged thread pitch wide enough to be fast under job site conditions and easy to assemble. They also have a smooth, wide, concentric, surface ideal for torque tensioning. This combination offers tremendous savings over inefficient hot rolled non-concentric thread-forms.

Williams All-Thread-Bars are threaded around the full circumference enabling the load transfer from the bar to the fasteners to occur efficiently without eccentric point loading. Williams fasteners easily meet the allowable load transfer limitations set forth by the Post Tensioning Institute (of the United States). Unlike competing hot rolled threaded bars and cast fasteners, Williams 150 KSI All-Thread-Bars and fasteners are machined to tight tolerances for superior performance and mechanical lock. Precision machining greatly reduces concern of fastener loosening or detensioning. 150 KSI All-Thread-Bars meet or exceed the deformation requirements under ASTM A-615 for concrete reinforcing bars.

Steel Quality

Williams 1", 1-1/4", and 1-3/8" 150 KSI All-Thread-Bars are hot-rolled, high strength steel. The bars are cold stressed and stress relieved to produce specific properties. All bars are produced to ASTM A-722-98 physical standards. The 1-3/4", 2-1/2" and 3" All-Thread-Bars are cold drawn through a series of tenisle and compressive stresses to produce a cold-stressed bar. They are then stressed relieved.

Thorough inspection and traceability are carried out during all phases of manufacturing to assure the highest standards of quality. Mill certifications and certificates of conformance can be provided with each shipment as an assurance that the mechanical properties of Williams All-Thread-Bar are as shown..

Welding

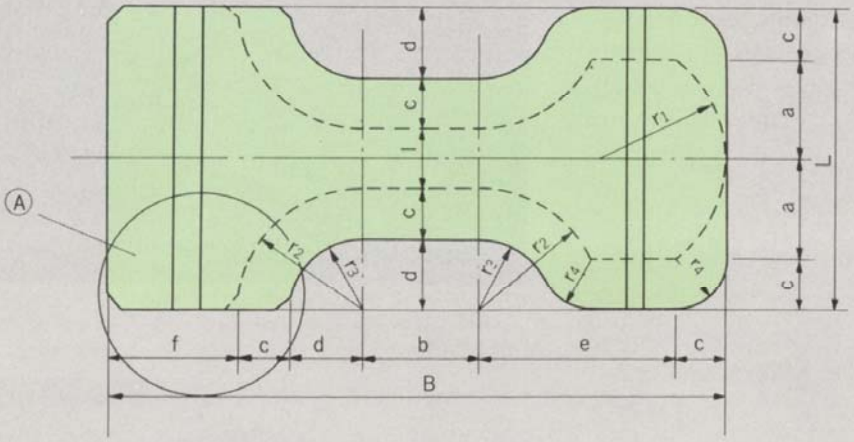
Williams 150 KSI All-Thread-Bar should not be subjected to the heat of a torch, welding or used as a ground. Field cutting should be done with an abrasive wheel or band saw.

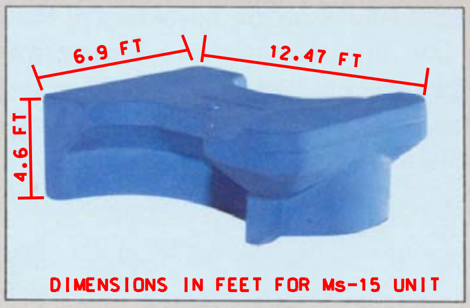
Tensile Strength & Working Loads

Williams 150 KSI All-Thread-Bars are available with ultimate tensile strengths and working loads as displayed above. Safety factors and functional working loads are at the discretion of the project design engineer, however test loads should never exceed 80% of the published ultimate bar strength.

Threaded Bar Types | 150 KSI Information | 150 KSI Accessories | Case Histories | Corrosion Protection

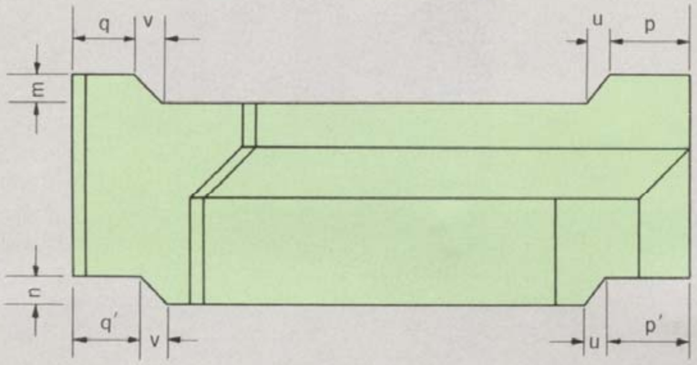
DIMENSIONS OF IGLOO UNITS





DIMENSIONS IN FEET FOR Ms-15 UNIT

APPROXIMATE WEIGHT OF Ms-15 UNIT
IS 17.1 TONS



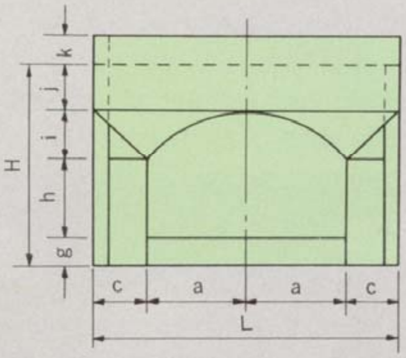


TABLE OF DIMENSIONS

(unit: mm)

Type	Weight (γ=2.3t/m^3)	Volume (m^3)	Mold Area (m^2)	Reinforcement (kg)	L	B	H	r_1	r_2	r_3	r_4	a	b	c	d	e
M_S-15	14.862	6.462	22.454	112.13	2,100	3,800	1,400	875	800	490	350	700	800	350	490	1,350
M_M-26	25.930	11.274	31.095	237.88	3,000	4,500	1,400	1,250	1,200	700	500	1,000	600	500	700	1,700
M_M-30	30.194	13.128	35.600	254.53	3,000	4,500	1,700	1,250	1,200	700	500	1,000	600	500	700	1,700
M_L-34	34.173	14.858	39.019	324.91	3,000	6,000	1,400	1,250	1,200	700	500	1,000	1,550	500	700	1,700
M_L-40	39.969	17.378	44.424	357.35	3,000	6,000	1,700	1,250	1,200	700	500	1,000	1,550	500	700	1,700

(per one unit)

	f	g	h	i	j	k	l	m	n	p	p'	q	q'	u	v	w	x
M_S-15	460	200	550	350	300	195	420	–	–	550	570	–	–	150	–	100	50
M_M-26	500	200	450	450	300	195	600	–	–	580	600	–	–	200	–	100	100
M_M-30	500	200	750	450	300	195	600	–	–	580	600	–	–	200	–	100	100
M_L-34	1,050	200	450	450	300	195	600	195	200	580	600	480	500	200	200	100	100
M_L-40	1,050	200	750	450	300	195	600	195	200	580	600	480	500	200	200	100	100

PRECAST CONCRETE UNIT, IGLOO, SHAPE AND DIMENSIONS

Tab F
Preliminary Cost Estimates

Feasibility Study CDF#2 March 2009 Revision
REVISED New CDF Alternatives 2
Revised estimate include new labor rates and escalated stone price quotes to current (4th Qtr FY08) dollars.
Estimate NOT escalated to Future $$.
March 2009 - Add Mitigation measures to estimate

Estimated by	James Dean
Designed by	Reed Vetovitz
Prepared by	James Wryk
Preparation Date	8/19/2008
Effective Date of Pricing	8/19/2008
Estimated Construction Time	Days

Date	Author	Note
8/24/2006	JSD	Quotes for stone materials received from Marblehead Quarries, LaFarge Corporation on August 24, 2006. Allen Boros, Territory Manager. 419-290-5076. All prices are FOB Contractor's barge. Does not include any transportation charges.
8/24/2006	JSD	According to Mr. Boros the reason for the high unit price for Armor Stone for Alternatives #2 and #3 are because the quarry will have to set-up of a new production area so as not to interfere with normal quarry production operations. Mr. Boros estimated that annual production of Type A stone would be between 80,000 tons and 100,000 tons.
8/25/2006	JSD	Quantities of materials were based on design documents provided by designer. Designer provided the in-place volumes and conversion factors for determining quantities of stone.
8/28/2006	jsd	15% contingency has been added to this estimate. In addition the price quote from the quarry is on the conservative side not only because of the opening of a new section of quarry but for the uncertainties in the design at the time of the price quote.
7/18/2008	JRW	This file contain revisions to bring the estimate up to current prices. Material price quotes have been escalated to current pricing, labor and equipment rates have been checked.
9/8/2008	jw	Revised estimate include new labor rates and escalated stone price quotes to current (4th Qtr FY08) dollars. Estimate NOT escalated to Future $$.
9/9/2008	jw	Estimate broken into 2 cells. Because the cells may be completed by different contracts, Mob/Demob, Wier Structure and fish removal is added to both cells of the estimate.
12/29/2008	jw	Contingencies updated based on Cost Risk Analysis worked up by Walla Walla District. Equipment Rates updated to latest database Labor Rates updated to latest labor rates

Description	Quantity	UOM	ContractCost	Contingency	ProjectCost
Project Cost Summary Report			**196,793,898**	**51,154,190**	**247,948,088**
CDF #2 - 108 acres	**7,200,000.00**	**CY**	*27.33* **196,793,898**	**51,154,190**	*34.44* **247,948,088**
General Conditions	**1.00**	**EA**	*1,353,639.54* **1,353,640**	**352,758**	*1,706,398.01* **1,706,398**
Temporary Office	**1.00**	**EA**	*67,869.73* **67,870**	**17,687**	*85,556.58* **85,557**
Submittals	**1.00**	**LS**	**49,555**	**12,914**	**62,469**
Mob and Demob	**1.00**	**LS**	**182,756**	**47,626**	**230,382**
Quality Control On-Site	**1.00**	**EA**	*1,053,459.23* **1,053,459**	**274,531**	*1,327,990.71* **1,327,991**
Type A	**382,000.00**	**TON**	*84.12* **32,133,197**	**8,373,911**	*106.04* **40,507,108**
Type B	**508,000.00**	**TON**	*76.79* **39,011,337**	**10,166,354**	*96.81* **49,177,692**
Type C	**1,700,000.00**	**TON**	*43.70* **74,284,952**	**19,358,659**	*55.08* **93,643,611**
Type D	**89,000.00**	**TON**	*19.80* **1,762,035**	**459,186**	*24.96* **2,221,221**
Type E	**891,000.00**	**TON**	*43.70* **38,934,054**	**10,146,215**	*55.08* **49,080,269**
Type F	**84,000.00**	**TON**	*19.67* **1,652,371**	**430,608**	*24.80* **2,082,979**
Type H	**52,000.00**	**TON**	*52.44* **2,726,798**	**710,603**	*66.10* **3,437,401**
Weir and Walkway	**1.00**	**EA**	*52,680.23* **52,680**	**13,728**	*66,408.69* **66,409**
Wier	**1.00**	**EA**	*46,757.03* **46,757**	**12,185**	*58,941.91* **58,942**
Walkway, Railing and Ladder	**1.00**	**EA**	*5,923.19* **5,923**	**1,544**	*7,466.78* **7,467**
Steel Sheet Pile Wall	**9,135.00**	**LF**	*479.78* **4,382,835**	**1,142,167**	*604.82* **5,525,002**

Description	Quantity	UOM	ContractCost	Contingency	ProjectCost
			2,504.48		*3,157.14*
CZ67	**1,750.00**	**TON**	**4,382,835**	**1,142,167**	**5,525,002**
Mitagation	**1.00**	**LS**	**500,000**	**0**	**500,000**

Description	Quantity	UOM	DirectCost	SubCMU	PrimeCMU	ContractCost
Contract Cost Summary Report			**159,199,200**	**0**	**37,594,698**	**196,793,898**
CDF #2 - 108 acres	**7,200,000.00**	**CY**	*22.11* **159,199,200**	**0**	**37,594,698**	*27.33* **196,793,898**
General Conditions	**1.00**	**EA**	*1,094,387.11* **1,094,387**	**0**	**259,252**	*1,353,639.54* **1,353,640**
Temporary Office	**1.00**	**EA**	*54,871.15* **54,871**	**0**	**12,999**	*67,869.73* **67,870**
Submittals	**1.00**	**LS**	**40,064**	**0**	**9,491**	**49,555**
Mob and Demob	**1.00**	**LS**	**147,754**	**0**	**35,002**	**182,756**
Quality Control On-Site	**1.00**	**EA**	*851,698.09* **851,698**	**0**	**201,761**	*1,053,459.23* **1,053,459**
Type A	**382,000.00**	**TON**	*68.01* **25,978,966**	**0**	**6,154,230**	*84.12* **32,133,197**
Type B	**508,000.00**	**TON**	*62.09* **31,539,788**	**0**	**7,471,549**	*76.79* **39,011,337**
Type C	**1,700,000.00**	**TON**	*35.33* **60,057,713**	**0**	**14,227,240**	*43.70* **74,284,952**
Type D	**89,000.00**	**TON**	*16.01* **1,424,566**	**0**	**337,469**	*19.80* **1,762,035**
Type E	**891,000.00**	**TON**	*35.33* **31,477,307**	**0**	**7,456,747**	*43.70* **38,934,054**
Type F	**84,000.00**	**TON**	*15.90* **1,335,905**	**0**	**316,466**	*19.67* **1,652,371**
Type H	**52,000.00**	**TON**	*42.40* **2,204,554**	**0**	**522,243**	*52.44* **2,726,798**
Weir and Walkway	**1.00**	**EA**	*42,590.78* **42,591**	**0**	**10,089**	*52,680.23* **52,680**
Wier	**1.00**	**EA**	*37,802.01* **37,802**	**0**	**8,955**	*46,757.03* **46,757**
Walkway, Railing and Ladder	**1.00**	**EA**	*4,788.77* **4,789**	**0**	**1,134**	*5,923.19* **5,923**
Steel Sheet Pile Wall	**9,135.00**	**LF**	*387.90* **3,543,423**	**0**	**839,411**	*479.78* **4,382,835**

Description	Quantity	UOM	DirectCost	SubCMU	PrimeCMU	ContractCost
			2,024.81			*2,504.48*
CZ67	**1,750.00**	**TON**	**3,543,423**	**0**	**839,411**	**4,382,835**
Mitagation	**1.00**	**LS**	**500,000**	**0**	**0**	**500,000**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Estimators Jud	DirectMU	DirectCost
Project Direct Costs Report			**10,056,514**	**19,810,182**	**123,803,497**	**15,600**	**500,000**	**5,013,407**	**159,199,200**
			1.40	*2.75*	*17.19*	*0.00*		*0.70*	*22.11*
CDF #2 - 108 acres	**7,200,000.00**	**CY**	**10,056,514**	**19,810,182**	**123,803,497**	**15,600**	**500,000**	**5,013,407**	**159,199,200**
			525,275.40	*270,502.80*	*31,600.00*	*15,600.00*		*251,408.92*	*1,094,387.11*
General Conditions	**1.00**	**EA**	**525,275**	**270,503**	**31,600**	**15,600**	**0**	**251,409**	**1,094,387**
			16,773.12	*0.00*	*14,400.00*	*15,600.00*		*8,098.03*	*54,871.15*
Temporary Office	**1.00**	**EA**	**16,773**	**0**	**14,400**	**15,600**	**0**	**8,098**	**54,871**
			0.00	*0.00*	*300.00*	*0.00*	*0.00*	*0.00*	*300.00*
AF 015205000550 Office Trailer, furnished, rent per month, 50' x 12', excl. hookups	36.00	MO	0	0	10,800	0	0	0	10,800
			0.00	*0.00*	*0.00*	*400.00*	*0.00*	*0.00*	*400.00*
USR Utility Costs	36.00	MO	0	0	0	14,400	0	0	14,400
(Note: Include Electric, Phone, Fax and Supplies)									
USR Mob and Demob Office Trailer	1.00	LS	0	0	0	1,200	0	0	1,200
			465.92	*0.00*	*100.00*	*0.00*	*0.00*	*224.95*	*790.87*
USR Janitorial	36.00	MO	16,773	0	3,600	0	0	8,098	28,471
Submittals	**1.00**	**LS**	**20,003**	**0**	**10,000**	**0**	**0**	**10,061**	**40,064**
USR Reproduction and Mail	1.00	LS	0	0	10,000	0	0	0	10,000
			666.76	*0.00*	*0.00*	*0.00*	*0.00*	*335.37*	*1,002.13*
USR Initial Project Submittals	30.00	DAY	20,003	0	0	0	0	10,061	30,064
Mob and Demob	**1.00**	**LS**	**45,671**	**82,240**	**0**	**0**	**0**	**19,844**	**147,754**
(Note: Assume 3 days initial mob + 2 days demob year 1 + 2 days mob year 2 + 2 days demob year 2 + year 3 (11 days @ 12 hrs/day))									
			144.48	*360.68*	*0.00*	*0.00*	*0.00*	*61.65*	*566.82*
USR 1 tug + 4 barges + 1 Eng + 1 Oper + 2 Tug Workers	132.00	HR	19,071	47,610	0	0	0	8,138	74,820
			201.51	*262.35*	*0.00*	*0.00*	*0.00*	*88.68*	*552.53*
USR 1 Spud Barge + 1 Crane + 1 tug + 2 Oper + 2 Deck	132.00	HR	26,599	34,630	0	0	0	11,705	72,934
			442,828.80	*188,263.19*	*7,200.00*	*0.00*		*213,406.10*	*851,698.09*
Quality Control On-Site	**1.00**	**EA**	**442,829**	**188,263**	**7,200**	**0**	**0**	**213,406**	**851,698**
			12,300.80	*5,229.53*	*200.00*	*0.00*	*0.00*	*5,927.95*	*23,658.28*
USR Quality Control	36.00	MO	442,829	188,263	7,200	0	0	213,406	851,698
			3.13	*6.00*	*57.25*	*0.00*		*1.63*	*68.01*
Type A	**382,000.00**	**TON**	**1,196,395**	**2,290,106**	**21,869,500**	**0**	**0**	**622,965**	**25,978,966**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Estimators Jud	DirectMU	DirectCost
			1.53	*1.99*	*57.25*	*0.00*	*0.00*	*0.92*	*61.69*
USR Type A Armor Stone (5 ton to 10 ton)	382,000.00	TON	583,158	759,212	21,869,500	0	0	352,168	23,564,038
			1.61	*4.01*	*0.00*	*0.00*	*0.00*	*0.71*	*6.32*
USR Haul from Sandusky	382,000.00	TON	613,237	1,530,894	0	0	0	270,797	2,414,929
(Note: 2400 tons per cycle, 24 hrs per cycle)									
			2.79	*5.55*	*52.32*	*0.00*		*1.42*	*62.09*
Type B	**508,000.00**	**TON**	**1,417,669**	**2,819,799**	**26,578,560**	**0**	**0**	**723,761**	**31,539,788**
			1.19	*1.54*	*52.32*	*0.00*	*0.00*	*0.72*	*55.76*
USR Type B Stone (600 lb to 2000 lb) Placed for CDF	508,000.00	TON	602,159	783,950	26,578,560	0	0	363,643	28,328,312
			1.61	*4.01*	*0.00*	*0.00*	*0.00*	*0.71*	*6.32*
USR Haul from Sandusky	508,000.00	TON	815,509	2,035,849	0	0	0	360,118	3,211,476
(Note: 2400 tons per cycle, 24 hrs per cycle)									
			2.40	*5.04*	*26.71*	*0.00*		*1.19*	*35.33*
Type C	**1,700,000.00**	**TON**	**4,072,467**	**8,561,850**	**45,407,000**	**0**	**0**	**2,016,396**	**60,057,713**
			0.79	*1.03*	*26.71*	*0.00*	*0.00*	*0.48*	*29.01*
USR Type C Stone	1,700,000.00	TON	1,343,400	1,748,970	45,407,000	0	0	811,277	49,310,647
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)									
			1.61	*4.01*	*0.00*	*0.00*	*0.00*	*0.71*	*6.32*
USR Haul from Sandusky	1,700,000.00	TON	2,729,067	6,812,881	0	0	0	1,205,118	10,747,066
(Note: 2400 tons per trip, 24 hrs per trip)									
			2.31	*4.93*	*7.63*	*0.00*		*1.14*	*16.01*
Type D	**89,000.00**	**TON**	**205,802**	**438,600**	**679,070**	**0**	**0**	**101,093**	**1,424,566**
			0.71	*0.92*	*7.63*	*0.00*	*0.00*	*0.43*	*9.68*
USR Type D Stone	89,000.00	TON	62,928	81,925	679,070	0	0	38,002	861,925
(Note: (4" Minus) ODOT 703.19A Crushed Ag clev e brkwtr 30/ton)									
			1.61	*4.01*	*0.00*	*0.00*	*0.00*	*0.71*	*6.32*
USR Haul from Sandusky	89,000.00	TON	142,875	356,674	0	0	0	63,091	562,641
(Note: 2400 tons per trip, 24 hrs per trip)									
			2.40	*5.04*	*26.71*	*0.00*		*1.19*	*35.33*
Type E	**891,000.00**	**TON**	**2,134,452**	**4,487,417**	**23,798,610**	**0**	**0**	**1,056,829**	**31,477,307**
			0.79	*1.03*	*26.71*	*0.00*	*0.00*	*0.48*	*29.01*
USR Type C and E Stone	891,000.00	TON	704,100	916,666	23,798,610	0	0	425,205	25,844,580
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)									

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Estimators Jud	DirectMU	DirectCost
			1.61	*4.01*	*0.00*	*0.00*	*0.00*	*0.71*	*6.32*
USR Haul from Sandusky	891,000.00	TON	1,430,352	3,570,751	0	0	0	631,624	5,632,727
(Note: 2400 tons per trip, 24 hrs per trip)									
			2.28	*4.88*	*7.63*	*0.00*		*1.11*	*15.90*
Type F	**84,000.00**	**TON**	**191,271**	**410,093**	**640,920**	**0**	**0**	**93,621**	**1,335,905**
			0.67	*0.87*	*7.63*	*0.00*	*0.00*	*0.41*	*9.58*
USR Type F Stone	84,000.00	TON	56,423	73,457	640,920	0	0	34,074	804,873
(Note: (3/4" to 1") ODOT 703.01 Size No. 68 clev e brkwtr 20/ton)									
			1.61	*4.01*	*0.00*	*0.00*	*0.00*	*0.71*	*6.32*
USR Haul from Sandusky	84,000.00	TON	134,848	336,636	0	0	0	59,547	531,031
(Note: 2400 tons per trip, 24 hrs per trip)									
			2.54	*5.23*	*33.35*	*0.00*		*1.27*	*42.40*
Type H	**52,000.00**	**TON**	**132,215**	**271,845**	**1,734,200**	**0**	**0**	**66,295**	**2,204,554**
			0.94	*1.22*	*33.35*	*0.00*	*0.00*	*0.57*	*36.07*
USR Type H Stone	52,000.00	TON	48,737	63,451	1,734,200	0	0	29,432	1,875,821
(Note: (6" - 18") ODOT 703.19B Type C)									
			1.61	*4.01*	*0.00*	*0.00*	*0.00*	*0.71*	*6.32*
USR Haul from Sandusky	52,000.00	TON	83,477	208,394	0	0	0	36,862	328,734
(Note: 2400 tons per trip, 24 hrs per trip)									
			16,530.73	*14,806.19*	*4,036.50*	*0.00*		*7,217.36*	*42,590.78*
Weir and Walkway	**1.00**	**EA**	**16,531**	**14,806**	**4,037**	**0**	**0**	**7,217**	**42,591**
(Note: Quantities obtained from Dike 10b IGE dated June 1996)									
			15,072.96	*14,718.70*	*1,420.50*	*0.00*		*6,589.84*	*37,802.01*
Wier	**1.00**	**EA**	**15,073**	**14,719**	**1,421**	**0**	**0**	**6,590**	**37,802**
			16.75	*16.35*	*0.70*	*0.00*	*0.00*	*7.32*	*41.12*
MIL 031104300150 C.I.P. concrete forms, footing, continuous wall, plywood, 4 use, includes erecting, bracing, stripping and cleaning	300.00	SFC	5,024	4,906	210	0	0	2,197	12,337
			2,512.16	*2,453.12*	*541.50*	*0.00*	*0.00*	*1,098.31*	*6,605.08*
MIL 032106000700 Reinforcing steel, in place, walls, #3 to #7, A615, grade 60	1.00	TON	2,512	2,453	542	0	0	1,098	6,605
			418.69	*408.85*	*0.00*	*0.00*	*0.00*	*183.05*	*1,010.60*
USR 033107005400 Structural concrete, placing, walls, with crane and bucket, 15" thick, includes vibrating, excludes material	6.00	CY	2,512	2,453	0	0	0	1,098	6,064

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Estimators Jud	DirectMU	DirectCost
			0.00	*0.00*	*110.00*	*0.00*	*0.00*	*0.00*	*110.00*
MIL 033102200300 Structural concrete, ready mix, normal weight, 4000 PSI, includes material only	6.00	CY	0	0	660	0	0	0	660
			16.75	*16.35*	*0.03*	*0.00*	*0.00*	*7.32*	*40.45*
MIL 033503500010 Concrete finishing, walls, includes breaking ties and patching voids	300.00	SF	5,024	4,906	9	0	0	2,197	12,136
			1,457.77	*87.49*	*2,616.00*	*0.00*		*627.51*	*4,788.77*
Walkway, Railing and Ladder	**1.00**	**EA**	**1,458**	**87**	**2,616**	**0**	**0**	**628**	**4,789**
			9.02	*0.48*	*19.75*	*0.00*	*0.00*	*3.88*	*33.13*
RSM 055207000020 Railing, pipe, aluminum, satin finish, 2 rails, 1-1/4" dia	20.00	LF	180	10	395	0	0	78	663
			2.41	*0.13*	*10.70*	*0.00*	*0.00*	*1.04*	*14.27*
MIL 055303400694 Floor grating, steel, galvanized, 1-1/4" x 3/16" bearing bars @ 15/16" O.C., cross bars @ 4" O.C., 9.1 #/S.F., up to 300 S.F.	100.00	SF	241	13	1,070	0	0	104	1,427
			30.18	*2.12*	*6.55*	*0.00*	*0.00*	*13.00*	*51.86*
MIL 051204400672 Channel framing, structural steel, field fabricated, C8x11.5, incl cutting & welding	20.00	LF	604	42	131	0	0	260	1,037
			28.87	*1.53*	*68.00*	*0.00*	*0.00*	*12.42*	*110.82*
MIL 055145000020 Ladder, steel, 20" W, bolted to concrete, incl cage	15.00	VLF	433	23	1,020	0	0	186	1,662
			18.00	*26.84*	*334.98*	*0.00*		*8.08*	*387.90*
Steel Sheet Pile Wall	**9,135.00**	**LF**	**164,438**	**245,164**	**3,060,000**	**0**	**0**	**73,821**	**3,543,423**
			93.96	*140.09*	*1,748.57*	*0.00*		*42.18*	*2,024.81*
CZ67	**1,750.00**	**TON**	**164,438**	**245,164**	**3,060,000**	**0**	**0**	**73,821**	**3,543,423**
			91.35	*136.20*	*1,700.00*	*0.00*	*0.00*	*41.01*	*1,968.57*
USR Marine Sheet piling, steel, 38 psf, 40' excavation, left in place, excludes wales	1,800.00	TON	164,438	245,164	3,060,000	0	0	73,821	3,543,423
(Note: Modified for Marine Plant Sttel Sheet Pile price adjusted from $816.21 ton to more current prices of $1700/ton)									
Mitigation	**1.00**	**LS**	**0**	**0**	**0**	**0**	**500,000**	**0**	**500,000**
USR Mitigation	1.00	LS	0	0	0	0	500,000	0	500,000
(Note: Per PM Mitagation costs from Friends of Chicago River project escalated to the scope of this project. Leave contractor unassigned.)									

Description **Page**

Feasibility Study Aug 2006MII VER3_Revision Dec 2008 Plan 3
REVISED New CDF Alternatives 3,
Revised estimate include new labor rates and esculated stone price quotes to current (4th Qtr FY08) dollars.
Estimate NOT escaluated to Future $$.
THIS ESTIMATE CONTAINS A SMALLER FOOTPRINT, REDUCING THE OPEN WATER SECTION FROM 5430 LF TO 5180 LF. ACREAGE IS REDUCED FROM 129 TO 117 ACRES.
Mitagation measures added March 2009

Estimated by	James Dean
Designed by	Reed Vetovitz
Prepared by	James Wryk
Preparation Date	7/18/2008
Effective Date of Pricing	7/18/2008
Estimated Construction Time	Days

Date	Author	Note
8/24/2006	JSD	Quotes for stone materials received from Marblehead Quarries, LaFarge Corporation on August 24, 2006. Allen Boros, Territory Manager. 419-290-5076. All prices are FOB Contractor's barge. Does not include any transportation charges.
8/24/2006	JSD	According to Mr. Boros the reason for the high unit price for Armor Stone for Alternatives #2 and #3 are because the quarry will have to set-up of a new production area so as not to interfere with normal quarry production operations. Mr. Boros estimated that annual production of Type A stone would be between 80,000 tons and 100,000 tons.
8/25/2006	JSD	Quantities of materials were based on design documents provided by designer. Designer provided the in-place volumes and conversion factors for determining quantities of stone.
8/28/2006	jsd	15% contingency has been added to this estimate. In addition the price quote from the quarry is on the conservative side not only because of the opening of a new section of quarry but for the uncertainties in the design at the time of the price quote.
7/18/2008	jw	This file contain revisions to bring the estimate up to current prices. Material price quotes have been escalated to current pricing, labor and equipment rates have been checked.
9/8/2008	jw	Revised estimate include new labor rates and esculated stone price quotes to current (4th Qtr FY08) dollars. Estimate NOT escaluated to Future $$.
9/30/2008	jw	Revision to CDF #3 - includes adjusted layout - The open water containment dike is shortened to 5180 lf while the rest of the wall lengths remain the same. Total area and volume of cdf is reduced 129 acres and 8 million cy capacity to 117 acres and 7.2 million cy. Estimate is same as previous but the quantities have been changed to reflect the new design.

Description	Quantity	UOM	ContractCost	Contingency	ProjectCost
Project Cost Summary Report			**163,011,952**	**43,179,426**	**206,191,378**
CDF #3 - 117 acres	**8,000,000.00**	**CY**	*20.38* **163,011,952**	**43,179,426**	*25.77* **206,191,378**
General Conditions	**1.00**	**EA**	*1,323,874.94* **1,323,875**	**351,754**	*1,675,628.51* **1,675,629**
Temporary Office	**1.00**	**EA**	*67,721.97* **67,722**	**17,994**	*85,715.70* **85,716**
Submittals	**1.00**	**LS**	**49,447**	**13,138**	**62,585**
Mob and Demob	**1.00**	**LS**	**183,442**	**48,741**	**232,183**
Quality Control On-Site	**1.00**	**EA**	*1,023,263.73* **1,023,264**	**271,881**	*1,295,144.90* **1,295,145**
Type A	**367,000.00**	**TON**	*83.79* **30,749,848**	**8,170,235**	*106.05* **38,920,083**
Type B	**474,000.00**	**TON**	*76.48* **36,252,386**	**9,632,259**	*96.80* **45,884,645**
Type C	**1,001,000.00**	**TON**	*43.46* **43,504,076**	**11,559,033**	*55.01* **55,063,109**
Type D	**770,000.00**	**TON**	*19.61* **15,103,190**	**4,012,918**	*24.83* **19,116,108**
Type E	**620,000.00**	**TON**	*43.46* **26,945,582**	**7,159,441**	*55.01* **34,105,023**
Type F	**71,000.00**	**TON**	*19.49* **1,383,653**	**367,637**	*24.67* **1,751,290**
Type H	**60,000.00**	**TON**	*52.18* **3,130,896**	**831,879**	*66.05* **3,962,775**
Weir and Walkway	**1.00**	**EA**	*52,921.12* **52,921**	**14,061**	*66,982.26* **66,982**
Wier	**1.00**	**EA**	*47,023.40* **47,023**	**12,494**	*59,517.52* **59,518**
Walkway, Railing and Ladder	**1.00**	**EA**	*5,897.71* **5,898**	**1,567**	*7,464.74* **7,465**
Steel Sheet Pile Wall	**9,180.00**	**LF**	*442.87* **4,065,525**	**1,080,210**	*560.54* **5,145,735**

Description	Quantity	UOM	ContractCost	Contingency	ProjectCost
			2,427.18		*3,072.08*
CZ67	**1,675.00**	**TON**	**4,065,525**	**1,080,210**	**5,145,735**
Mitagation	**1.00**	**LS**	**500,000**	**0**	**500,000**

Description	Quantity	UOM	DirectCost	SubCMU	PrimeCMU	ContractCost
Contract Cost Summary Report			**132,173,920**	**4,893,674**	**25,944,358**	**163,011,952**
CDF #3 - 117 acres	**8,000,000.00**	**CY**	*16.52* **132,173,920**	**4,893,674**	**25,944,358**	*20.38* **163,011,952**
General Conditions	**1.00**	**EA**	*1,072,658.35* **1,072,658**	**0**	**251,217**	*1,323,874.94* **1,323,875**
Temporary Office	**1.00**	**EA**	*54,871.15* **54,871**	**0**	**12,851**	*67,721.97* **67,722**
Submittals	**1.00**	**LS**	**40,064**	**0**	**9,383**	**49,447**
Mob and Demob	**1.00**	**LS**	**148,633**	**0**	**34,810**	**183,442**
Quality Control On-Site	**1.00**	**EA**	*829,090.69* **829,091**	**0**	**194,173**	*1,023,263.73* **1,023,264**
Type A	**367,000.00**	**TON**	*67.89* **24,914,801**	**534,041**	**5,301,006**	*83.79* **30,749,848**
Type B	**474,000.00**	**TON**	*61.97* **29,373,186**	**689,742**	**6,189,458**	*76.48* **36,252,386**
Type C	**1,001,000.00**	**TON**	*35.21* **35,248,806**	**1,456,606**	**6,798,664**	*43.46* **43,504,076**
Type D	**770,000.00**	**TON**	*15.89* **12,237,231**	**1,120,467**	**1,745,493**	*19.61* **15,103,190**
Type E	**620,000.00**	**TON**	*35.21* **21,832,427**	**902,194**	**4,210,961**	*43.46* **26,945,582**
Type F	**71,000.00**	**TON**	*15.79* **1,121,093**	**103,316**	**159,244**	*19.49* **1,383,653**
Type H	**60,000.00**	**TON**	*42.28* **2,536,782**	**87,309**	**506,805**	*52.18* **3,130,896**
Weir and Walkway	**1.00**	**EA**	*42,878.88* **42,879**	**0**	**10,042**	*52,921.12* **52,921**
Wier	**1.00**	**EA**	*38,100.31* **38,100**	**0**	**8,923**	*47,023.40* **47,023**
Walkway, Railing and Ladder	**1.00**	**EA**	*4,778.57* **4,779**	**0**	**1,119**	*5,897.71* **5,898**
Steel Sheet Pile Wall	**9,180.00**	**LF**	*358.83* **3,294,057**	**0**	**771,468**	*442.87* **4,065,525**

Description	Quantity	UOM	DirectCost	SubCMU	PrimeCMU	ContractCost
CZ67	**1,675.00**	**TON**	*1,966.60* **3,294,057**	**0**	**771,468**	*2,427.18* **4,065,525**
Mitagation	**1.00**	**LS**	**500,000**	**0**	**0**	**500,000**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Estimators Jud	DirectMU	DirectCost
Project Direct Costs Report			**9,371,759**	**17,839,454**	**100,408,307**	**15,600**	**500,000**	**4,038,801**	**132,173,920**
			1.17	*2.23*	*12.55*	*0.00*		*0.50*	*16.52*
CDF #3 - 117 acres	**8,000,000.00**	**CY**	**9,371,759**	**17,839,454**	**100,408,307**	**15,600**	**500,000**	**4,038,801**	**132,173,920**
(Note: w/ no escalation)									
			526,463.40	*247,586.04*	*31,600.00*	*15,600.00*		*251,408.92*	*1,072,658.35*
General Conditions	**1.00**	**EA**	**526,463**	**247,586**	**31,600**	**15,600**	**0**	**251,409**	**1,072,658**
			16,773.12	*0.00*	*14,400.00*	*15,600.00*		*8,098.03*	*54,871.15*
Temporary Office	**1.00**	**EA**	**16,773**	**0**	**14,400**	**15,600**	**0**	**8,098**	**54,871**
			0.00	*0.00*	*300.00*	*0.00*	*0.00*	*0.00*	*300.00*
AF 015205000550 Office Trailer, furnished, rent per month, 50' x 12', excl. hookups	36.00	MO	0	0	10,800	0	0	0	10,800
			0.00	*0.00*	*0.00*	*400.00*	*0.00*	*0.00*	*400.00*
USR Utility Costs	36.00	MO	0	0	0	14,400	0	0	14,400
(Note: Include Electric, Phone, Fax and Supplies)									
USR Mob and Demob Office Trailer	1.00	LS	0	0	0	1,200	0	0	1,200
			465.92	*0.00*	*100.00*	*0.00*	*0.00*	*224.95*	*790.87*
USR Janitorial	36.00	MO	16,773	0	3,600	0	0	8,098	28,471
Submittals	**1.00**	**LS**	**20,003**	**0**	**10,000**	**0**	**0**	**10,061**	**40,064**
USR Reproduction and Mail	1.00	LS	0	0	10,000	0	0	0	10,000
			666.76	*0.00*	*0.00*	*0.00*	*0.00*	*335.37*	*1,002.13*
USR Initial Project Submittals	30.00	DAY	20,003	0	0	0	0	10,061	30,064
Mob and Demob	**1.00**	**LS**	**46,859**	**81,930**	**0**	**0**	**0**	**19,844**	**148,633**
(Note: Assume 3 days initial mob + 2 days demob year 1 + 2 days mob year 2 + 2 days demob year 2 + year 3 (11 days @ 12 hrs/day))									
			148.48	*357.88*	*0.00*	*0.00*	*0.00*	*61.65*	*568.01*
USR 1 tug + 4 barges + 1 Eng + 1 Oper + 2 Tug Workers	132.00	HR	19,599	47,240	0	0	0	8,138	74,977
			206.51	*262.81*	*0.00*	*0.00*	*0.00*	*88.68*	*557.99*
USR 1 Spud Barge + 1 Crane + 1 tug + 2 Oper + 2 Deck	132.00	HR	27,259	34,691	0	0	0	11,705	73,655
			442,828.80	*165,655.79*	*7,200.00*	*0.00*		*213,406.10*	*829,090.69*
Quality Control On-Site	**1.00**	**EA**	**442,829**	**165,656**	**7,200**	**0**	**0**	**213,406**	**829,091**
			12,300.80	*4,601.55*	*200.00*	*0.00*	*0.00*	*5,927.95*	*23,030.30*
USR Quality Control	36.00	MO	442,829	165,656	7,200	0	0	213,406	829,091

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Estimators Jud	DirectMU	DirectCost
			3.21	*5.97*	*57.25*	*0.00*		*1.46*	*67.89*
Type A	**367,000.00**	**TON**	**1,179,629**	**2,190,025**	**21,010,750**	**0**	**0**	**534,398**	**24,914,801**
			1.56	*1.99*	*57.25*	*0.00*	*0.00*	*0.87*	*61.67*
USR Type A Armor Stone (5 ton to 10 ton)	367,000.00	TON	574,160	730,683	21,010,750	0	0	318,932	22,634,526
			1.65	*3.98*	*0.00*	*0.00*	*0.00*	*0.59*	*6.21*
USR Haul from Sandusky	367,000.00	TON	605,468	1,459,341	0	0	0	215,466	2,280,276
(Note: 2400 tons per cycle, 24 hrs per cycle)									
			2.86	*5.52*	*52.32*	*0.00*		*1.26*	*61.97*
Type B	**474,000.00**	**TON**	**1,357,793**	**2,617,585**	**24,799,680**	**0**	**0**	**598,128**	**29,373,186**
			1.21	*1.55*	*52.32*	*0.00*	*0.00*	*0.67*	*55.76*
USR Type B Stone (600 lb to 2000 lb) Placed for CDF	474,000.00	TON	575,798	732,768	24,799,680	0	0	319,842	26,428,089
			1.65	*3.98*	*0.00*	*0.00*	*0.00*	*0.59*	*6.21*
USR Haul from Sandusky	474,000.00	TON	781,995	1,884,817	0	0	0	278,285	2,945,097
(Note: 2400 tons per cycle, 24 hrs per cycle)									
			2.46	*5.01*	*26.71*	*0.00*		*1.04*	*35.21*
Type C	**1,001,000.00**	**TON**	**2,462,081**	**5,012,030**	**26,736,710**	**0**	**0**	**1,037,986**	**35,248,806**
			0.81	*1.03*	*26.71*	*0.00*	*0.00*	*0.45*	*29.00*
USR Type C Stone	1,001,000.00	TON	810,653	1,031,646	26,736,710	0	0	450,298	29,029,308
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)									
			1.65	*3.98*	*0.00*	*0.00*	*0.00*	*0.59*	*6.21*
USR Haul from Sandusky	1,001,000.00	TON	1,651,428	3,980,383	0	0	0	587,687	6,219,498
(Note: 2400 tons per trip, 24 hrs per trip)									
			2.37	*4.90*	*7.63*	*0.00*		*0.99*	*15.89*
Type D	**770,000.00**	**TON**	**1,828,268**	**3,771,873**	**5,875,100**	**0**	**0**	**761,989**	**12,237,231**
			0.72	*0.92*	*7.63*	*0.00*	*0.00*	*0.40*	*9.68*
USR Type D Stone	770,000.00	TON	557,939	710,040	5,875,100	0	0	309,922	7,453,001
(Note: (4" Minus) ODOT 703.19A Crushed Ag clev e brkwtr 30/ton)									
			1.65	*3.98*	*0.00*	*0.00*	*0.00*	*0.59*	*6.21*
USR Haul from Sandusky	770,000.00	TON	1,270,329	3,061,833	0	0	0	452,067	4,784,229
(Note: 2400 tons per trip, 24 hrs per trip)									
			2.46	*5.01*	*26.71*	*0.00*		*1.04*	*35.21*
Type E	**620,000.00**	**TON**	**1,524,965**	**3,104,354**	**16,560,200**	**0**	**0**	**642,908**	**21,832,427**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Estimators Jud	DirectMU	DirectCost
			0.81	*1.03*	*26.71*	*0.00*	*0.00*	*0.45*	*29.00*
USR Type C and E Stone	620,000.00	TON	502,103	638,982	16,560,200	0	0	278,906	17,980,191
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)									
			1.65	*3.98*	*0.00*	*0.00*	*0.00*	*0.59*	*6.21*
USR Haul from Sandusky	620,000.00	TON	1,022,862	2,465,372	0	0	0	364,002	3,852,237
(Note: 2400 tons per trip, 24 hrs per trip)									
			2.34	*4.85*	*7.63*	*0.00*		*0.97*	*15.79*
Type F	**71,000.00**	**TON**	**166,008**	**344,523**	**541,730**	**0**	**0**	**68,832**	**1,121,093**
			0.69	*0.88*	*7.63*	*0.00*	*0.00*	*0.38*	*9.58*
USR Type F Stone	71,000.00	TON	48,874	62,198	541,730	0	0	27,148	679,950
(Note: (3/4" to 1") ODOT 703.01 Size No. 68 clev e brkwtr 20/ton)									
			1.65	*3.98*	*0.00*	*0.00*	*0.00*	*0.59*	*6.21*
USR Haul from Sandusky	71,000.00	TON	117,134	282,325	0	0	0	41,684	441,143
(Note: 2400 tons per trip, 24 hrs per trip)									
			2.61	*5.20*	*33.35*	*0.00*		*1.12*	*42.28*
Type H	**60,000.00**	**TON**	**156,617**	**311,926**	**2,001,000**	**0**	**0**	**67,238**	**2,536,782**
			0.96	*1.22*	*33.35*	*0.00*	*0.00*	*0.53*	*36.07*
USR Type H Stone	60,000.00	TON	57,631	73,342	2,001,000	0	0	32,012	2,163,985
(Note: (6" - 18") ODOT 703.19B Type C)									
			1.65	*3.98*	*0.00*	*0.00*	*0.00*	*0.59*	*6.21*
USR Haul from Sandusky	60,000.00	TON	98,987	238,584	0	0	0	35,226	372,797
(Note: 2400 tons per trip, 24 hrs per trip)									
			16,914.73	*14,710.29*	*4,036.50*	*0.00*		*7,217.36*	*42,878.88*
Weir and Walkway	**1.00**	**EA**	**16,915**	**14,710**	**4,037**	**0**	**0**	**7,217**	**42,879**
(Note: Quantities obtained from Dike 10b IGE dated June 1996)									
			15,456.96	*14,633.01*	*1,420.50*	*0.00*		*6,589.84*	*38,100.31*
Wier	**1.00**	**EA**	**15,457**	**14,633**	**1,421**	**0**	**0**	**6,590**	**38,100**
			17.17	*16.26*	*0.70*	*0.00*	*0.00*	*7.32*	*41.46*
MIL 031104300150 C.I.P. concrete forms, footing, continuous wall, plywood, 4 use, includes erecting, bracing, stripping and cleaning	300.00	SFC	5,152	4,878	210	0	0	2,197	12,437
			2,576.16	*2,438.83*	*541.50*	*0.00*	*0.00*	*1,098.31*	*6,654.80*
MIL 032106000700 Reinforcing steel, in place, walls, #3 to #7, A615, grade 60	1.00	TON	2,576	2,439	542	0	0	1,098	6,655

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Estimators Jud	DirectMU	DirectCost
			429.36	*406.47*	*0.00*	*0.00*	*0.00*	*183.05*	*1,018.88*
USR 033107005400 Structural concrete, placing, walls, with crane and bucket, 15" thick, includes vibrating, excludes material	6.00	CY	2,576	2,439	0	0	0	1,098	6,113
			0.00	*0.00*	*110.00*	*0.00*	*0.00*	*0.00*	*110.00*
MIL 033102200300 Structural concrete, ready mix, normal weight, 4000 PSI, includes material only	6.00	CY	0	0	660	0	0	0	660
			17.17	*16.26*	*0.03*	*0.00*	*0.00*	*7.32*	*40.79*
MIL 033503500010 Concrete finishing, walls, includes breaking ties and patching voids	300.00	SF	5,152	4,878	9	0	0	2,197	12,236
			1,457.77	*77.29*	*2,616.00*	*0.00*		*627.51*	*4,778.57*
Walkway, Railing and Ladder	**1.00**	**EA**	**1,458**	**77**	**2,616**	**0**	**0**	**628**	**4,779**
			9.02	*0.42*	*19.75*	*0.00*	*0.00*	*3.88*	*33.07*
RSM 055207000020 Railing, pipe, aluminum, satin finish, 2 rails, 1-1/4" dia	20.00	LF	180	8	395	0	0	78	661
			2.41	*0.11*	*10.70*	*0.00*	*0.00*	*1.04*	*14.25*
MIL 055303400694 Floor grating, steel, galvanized, 1-1/4" x 3/16" bearing bars @ 15/16" O.C., cross bars @ 4" O.C., 9.1 #/S.F., up to 300 S.F.	100.00	SF	241	11	1,070	0	0	104	1,425
			30.18	*1.87*	*6.55*	*0.00*	*0.00*	*13.00*	*51.61*
MIL 051204400672 Channel framing, structural steel, field fabricated, C8x11.5, incl cutting & welding	20.00	LF	604	37	131	0	0	260	1,032
			28.87	*1.35*	*68.00*	*0.00*	*0.00*	*12.42*	*110.64*
MIL 055145000020 Ladder, steel, 20" W, bolted to concrete, incl cage	15.00	VLF	433	20	1,020	0	0	186	1,660
			16.67	*24.49*	*310.19*	*0.00*		*7.48*	*358.83*
Steel Sheet Pile Wall	**9,180.00**	**LF**	**153,019**	**224,843**	**2,847,500**	**0**	**0**	**68,695**	**3,294,057**
			91.35	*134.23*	*1,700.00*	*0.00*		*41.01*	*1,966.60*
CZ67	**1,675.00**	**TON**	**153,019**	**224,843**	**2,847,500**	**0**	**0**	**68,695**	**3,294,057**
			91.35	*134.23*	*1,700.00*	*0.00*	*0.00*	*41.01*	*1,966.60*
USR Marine Sheet piling, steel, 38 psf, 40' excavation, left in place, excludes wales	1,675.00	TON	153,019	224,843	2,847,500	0	0	68,695	3,294,057
(Note: Modified for Marine Plant.)									
Mitagation	**1.00**	**LS**	**0**	**0**	**0**	**0**	**500,000**	**0**	**500,000**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Estimators Jud	DirectMU	DirectCost
USR Mitagation	1.00	LS	0	0	0	0	500,000	0	500,000

(Note: Per PM Mitagation costs from Friends of Chicago River project escalated to the scope of this project. Leave contractor unassigned.)

Site 2A - 22 year Capacity

Site 2A - 22 Year Capacity

2 Cell structure similar to Site 3a. Inner cell to be constructed first is a steel cell structure and and cell 2 is a stone structure. Site is along the Cleveland Breakwater West side along the arrowhead breakwater

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Estimated by	JW
Designed by	Mike Mohr
Prepared by	James Wryk
Preparation Date	8/20/2008
Effective Date of Pricing	8/20/2008
Estimated Construction Time	Days

Date	Author	Note
8/24/2006	JSD	Quotes for stone materials received from Marblehead Quarries, LaFarge Corporation on August 24, 2006. Allen Boros, Territory Manager. 419-290-5076. All prices are FOB Contractor's barge. Does not include any transportation charges.
8/24/2006	JSD	According to Mr. Boros the reason for the high unit price for Armor Stone for Alternatives #2 and #3 are because the quarry will have to set-up of a new production area so as not to interfere with normal quarry production operations. Mr. Boros estimated that annual production of Type A stone would be between 80,000 tons and 100,000 tons.
8/25/2006	JSD	Quantities of materials were based on design documents provided by designer. Designer provided the in-place volumes and conversion factors for determining quantities of stone.
8/28/2006	jsd	15% contingency has been added to this estimate. In addition the price quote from the quarry is on the conservative side not only because of the opening of a new section of quarry but for the uncertainties in the design at the time of the price quote.
7/18/2008	jw	This file contain revisions to bring the estimate up to current prices. Material price quotes have been escalated to current pricing, labor and equipment rates have been checked.
8/26/2008	jw	Site 2A is on the Western edge of the breakwater from the arrowhead west. Site 2A is straddling both sides of the breakwater with Cell 1(Harbor Side) constructed of SSP wall with King Piles and Cell 2 on the Lake side being constructed outr of Stone.
9/8/2008	jw	Revised estimate include new labor rates and esculated stone price quotes to current (4th Qtr FY08) dollars. Estimate NOT escaluated to Future $$.
9/9/2008	jw	Estimate broken into 2 cells. Because the cells may be completed by different contracts, Mob/Demob, Wier Structure and fish removal is added to both cells of the estimate.
12/29/2008	jw	Contingencies updated based on Cost Risk Analysis worked up by Walla Walla District. Equipment Rates updated to latest database Labor Rates updated to latest labor rates

Description	Quantity	UOM	ContractCost	Contingency	ProjectCost
Project Cost Summary Report			**214,369,491**	**51,841,965**	**266,211,456**
Cell 1	**1.00**	**LS**	**96,766,878**	**23,395,691**	**120,162,569**
General Conditions	**1.00**	**EA**	*1,322,597.73* **1,322,598**	**320,598**	*1,643,195.42* **1,643,195**
Temporary Office	**1.00**	**EA**	*67,869.73* **67,870**	**16,452**	*84,321.35* **84,321**
Submittals	**1.00**	**LS**	**47,135**	**11,425**	**58,560**
Mob and Demob	**1.00**	**LS**	**181,470**	**43,988**	**225,459**
Quality Control On-Site	**1.00**	**EA**	*1,026,123.13* **1,026,123**	**248,732**	*1,274,855.37* **1,274,855**
PZC 13 Combi-wall	**4,400.00**	**LF**	*17,313.99* **76,181,534**	**18,466,404**	*21,510.90* **94,647,938**
C King Pile (Beam)	**103,350.60**	**LF**	*267.51* **27,646,899**	**6,701,608**	*332.35* **34,348,508**
C PZC 13	**7,891.00**	**TON**	*2,998.03* **23,657,446**	**5,734,565**	*3,724.75* **29,392,011**
C Tie Rods	**380.00**	**EA**	*12,001.57* **4,560,596**	**1,105,489**	*14,910.75* **5,666,085**
C Wales	**1,152,801.52**	**LB**	*4.91* **5,662,325**	**1,372,548**	*6.10* **7,034,873**
C Concrete Cap	**10,592.31**	**CY**	*535.08* **5,667,732**	**1,373,858**	*664.78* **7,041,590**
Granular Fill	**458,300.00**	**TON**	*19.61* **8,986,535**	**2,178,336**	*24.36* **11,164,872**
Wier Structure & Walkway	**1.00**	**LS**	**142,243**	**34,480**	**176,722**
Fish Removal	**1.00**	**EA**	*43,291.25* **43,291**	**10,494**	*53,785.05* **53,785**
Type A	**42,780.00**	**TON**	*83.79* **3,584,500**	**868,883**	*104.10* **4,453,383**
Type B	**39,060.00**	**TON**	*76.55* **2,990,211**	**724,827**	*95.11* **3,715,038**
Type C	**111,345.00**	**TON**	*43.56* **4,850,295**	**1,175,711**	*54.12* **6,026,006**

Description	Quantity	UOM	ContractCost	Contingency	ProjectCost
Type D	**37,050.00**	**TON**	*19.68* **729,288**	**176,779**	*24.46* **906,067**
Type E	**34,600.00**	**TON**	*99.21* **3,432,755**	**832,100**	*123.26* **4,264,855**
Type D	**98,200.00**	**TON**	*19.61* **1,925,546**	**466,752**	*24.36* **2,392,298**
Type F	**1,860.00**	**TON**	*19.57* **36,393**	**8,822**	*24.31* **45,215**
Type H	**61,300.00**	**TON**	*52.26* **3,203,770**	**776,594**	*64.93* **3,980,364**
Mitagation	**1.00**	**LS**	**250,000**	**0**	**250,000**
Cell 2	**1.00**	**LS**	**117,602,614**	**28,446,274**	**146,048,887**
General Conditions	**1.00**	**EA**	*1,322,597.73* **1,322,598**	**320,598**	*1,643,195.42* **1,643,195**
Temporary Office	**1.00**	**EA**	*67,869.73* **67,870**	**16,452**	*84,321.35* **84,321**
Submittals	**1.00**	**LS**	**47,135**	**11,425**	**58,560**
Mob and Demob	**1.00**	**LS**	**181,470**	**43,988**	**225,459**
Quality Control On-Site	**1.00**	**EA**	*1,026,123.13* **1,026,123**	**248,732**	*1,274,855.37* **1,274,855**
Type A	**336,310.00**	**TON**	*84.60* **28,453,074**	**6,897,025**	*105.11* **35,350,099**
Type B	**336,400.00**	**TON**	*77.37* **26,026,880**	**6,308,916**	*96.12* **32,335,795**
Type C	**938,800.00**	**TON**	*44.38* **41,659,733**	**10,098,319**	*55.13* **51,758,052**
Type D	**37,100.00**	**TON**	*20.50* **760,492**	**184,343**	*25.47* **944,835**
Type E	**247,200.00**	**TON**	*52.16* **12,895,173**	**3,125,790**	*64.81* **16,020,963**
Type D	**98,200.00**	**TON**	*19.61* **1,925,546**	**466,752**	*24.36* **2,392,298**

Description	Quantity	UOM	ContractCost	Contingency	ProjectCost
			20.38		*25.32*
Type F	**43,700.00**	**TON**	**890,634**	**215,890**	**1,106,524**
			53.08		*65.94*
Type H	**7,700.00**	**TON**	**408,703**	**99,070**	**507,773**
			51,923.10		*64,509.26*
Weir and Walkway	**1.00**	**EA**	**51,923**	**12,586**	**64,509**
			46,006.51		*57,158.48*
Wier	**1.00**	**EA**	**46,007**	**11,152**	**57,158**
			5,916.60		*7,350.78*
Walkway, Railing and Ladder	**1.00**	**EA**	**5,917**	**1,434**	**7,351**
			2,429.55		*3,018.48*
Steel Sheet Pile Wall	**2,010.00**	**TON**	**4,883,404**	**1,183,737**	**6,067,141**
			2,429.55		*3,018.48*
CZ67	**2,010.00**	**TON**	**4,883,404**	**1,183,737**	**6,067,141**
Mitagation	**1.00**	**LS**	**250,000**	**0**	**250,000**

Description	Quantity	UOM	DirectCost	SubCMU	PrimeCMU	ContractCost
Contract Cost Summary Report			**172,126,337**	**2,942,654**	**39,300,501**	**214,369,491**
Cell 1	**1.00**	**LS**	**78,281,724**	**0**	**18,485,154**	**96,766,878**
General Conditions	**1.00**	**EA**	*1,069,290.51* **1,069,291**	**0**	**253,307**	*1,322,597.73* **1,322,598**
Temporary Office	**1.00**	**EA**	*54,871.15* **54,871**	**0**	**12,999**	*67,869.73* **67,870**
Submittals	**1.00**	**LS**	**38,107**	**0**	**9,027**	**47,135**
Mob and Demob	**1.00**	**LS**	**146,715**	**0**	**34,756**	**181,470**
Quality Control On-Site	**1.00**	**EA**	*829,597.46* **829,597**	**0**	**196,526**	*1,026,123.13* **1,026,123**
PZC 13 Combi-wall	**4,400.00**	**LF**	*13,997.97* **61,591,056**	**0**	**14,590,478**	*17,313.99* **76,181,534**
C King Pile (Beam)	**103,350.60**	**LF**	*216.27* **22,351,896**	**0**	**5,295,003**	*267.51* **27,646,899**
C PZC 13	**7,891.00**	**TON**	*2,423.84* **19,126,513**	**0**	**4,530,933**	*2,998.03* **23,657,446**
C Tie Rods	**380.00**	**EA**	*9,703.00* **3,687,140**	**0**	**873,457**	*12,001.57* **4,560,596**
C Wales	**1,152,801.52**	**LB**	*3.97* **4,577,863**	**0**	**1,084,463**	*4.91* **5,662,325**
C Concrete Cap	**10,592.31**	**CY**	*432.60* **4,582,233**	**0**	**1,085,498**	*535.08* **5,667,732**
Granular Fill	**458,300.00**	**TON**	*15.85* **7,265,412**	**0**	**1,721,124**	*19.61* **8,986,535**
Wier Structure & Walkway	**1.00**	**LS**	**115,000**	**0**	**27,243**	**142,243**
Fish Removal	**1.00**	**EA**	*35,000.00* **35,000**	**0**	**8,291**	*43,291.25* **43,291**
Type A	**42,780.00**	**TON**	*67.74* **2,897,988**	**0**	**686,512**	*83.79* **3,584,500**
Type B	**39,060.00**	**TON**	*61.89* **2,417,518**	**0**	**572,693**	*76.55* **2,990,211**
Type C	**111,345.00**	**TON**	*35.22* **3,921,354**	**0**	**928,941**	*43.56* **4,850,295**

Description	Quantity	UOM	DirectCost	SubCMU	PrimeCMU	ContractCost
Type D	**37,050.00**	**TON**	*15.91* **589,613**	**0**	**139,675**	*19.68* **729,288**
Type E	**34,600.00**	**TON**	*80.21* **2,775,305**	**0**	**657,450**	*99.21* **3,432,755**
Type D	**98,200.00**	**TON**	*15.85* **1,556,761**	**0**	**368,785**	*19.61* **1,925,546**
Type F	**1,860.00**	**TON**	*15.82* **29,423**	**0**	**6,970**	*19.57* **36,393**
Type H	**61,300.00**	**TON**	*42.25* **2,590,176**	**0**	**613,594**	*52.26* **3,203,770**
Mitagation	**1.00**	**LS**	**250,000**	**0**	**0**	**250,000**
Cell 2	**1.00**	**LS**	**93,844,612**	**2,942,654**	**20,815,347**	**117,602,614**
General Conditions	**1.00**	**EA**	*1,069,290.51* **1,069,291**	**0**	**253,307**	*1,322,597.73* **1,322,598**
Temporary Office	**1.00**	**EA**	*54,871.15* **54,871**	**0**	**12,999**	*67,869.73* **67,870**
Submittals	**1.00**	**LS**	**38,107**	**0**	**9,027**	**47,135**
Mob and Demob	**1.00**	**LS**	**146,715**	**0**	**34,756**	**181,470**
Quality Control On-Site	**1.00**	**EA**	*829,597.46* **829,597**	**0**	**196,526**	*1,026,123.13* **1,026,123**
Type A	**336,310.00**	**TON**	*67.74* **22,782,193**	**508,237**	**5,162,644**	*84.60* **28,453,074**
Type B	**336,400.00**	**TON**	*61.89* **20,820,610**	**508,373**	**4,697,896**	*77.37* **26,026,880**
Type C	**938,800.00**	**TON**	*35.22* **33,062,710**	**1,418,729**	**7,178,294**	*44.38* **41,659,733**
Type D	**37,100.00**	**TON**	*15.91* **590,409**	**56,066**	**114,017**	*20.50* **760,492**
Type E	**247,200.00**	**TON**	*41.52* **10,262,664**	**373,572**	**2,258,937**	*52.16* **12,895,173**
Type D	**98,200.00**	**TON**	*15.85* **1,556,761**	**0**	**368,785**	*19.61* **1,925,546**

Description	**Quantity**	**UOM**	**DirectCost**	**SubCMU**	**PrimeCMU**	**ContractCost**
Type F	**43,700.00**	**TON**	*15.82* **691,279**	**66,040**	**133,315**	*20.38* **890,634**
Type H	**7,700.00**	**TON**	*42.25* **325,357**	**11,636**	**71,710**	*53.08* **408,703**
Weir and Walkway	**1.00**	**EA**	*41,978.66* **41,979**	**0**	**9,944**	*51,923.10* **51,923**
Wier	**1.00**	**EA**	*37,195.22* **37,195**	**0**	**8,811**	*46,006.51* **46,007**
Walkway, Railing and Ladder	**1.00**	**EA**	*4,783.44* **4,783**	**0**	**1,133**	*5,916.60* **5,917**
Steel Sheet Pile Wall	**2,010.00**	**TON**	*1,964.24* **3,948,122**	**0**	**935,282**	*2,429.55* **4,883,404**
CZ67	**2,010.00**	**TON**	*1,964.24* **3,948,122**	**0**	**935,282**	*2,429.55* **4,883,404**
Mitagation	**1.00**	**LS**	**250,000**	**0**	**0**	**250,000**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
Project Direct Costs Report			**12,609,622**	**18,203,290**	**130,372,148**	**31,200**	**4,732,233**	**500,000**	**5,677,843**	**172,126,337**
Cell 1	**1.00**	**LS**	**6,315,646**	**7,384,503**	**56,764,691**	**15,600**	**4,732,233**	**250,000**	**2,819,051**	**78,281,724**
			525,695.76	*244,873.95*	*31,600.00*	*15,600.00*			*251,520.80*	*1,069,290.51*
General Conditions	**1.00**	**EA**	**525,696**	**244,874**	**31,600**	**15,600**	**0**	**0**	**251,521**	**1,069,291**
			16,773.12	*0.00*	*14,400.00*	*15,600.00*			*8,098.03*	*54,871.15*
Temporary Office	**1.00**	**EA**	**16,773**	**0**	**14,400**	**15,600**	**0**	**0**	**8,098**	**54,871**
			0.00	*0.00*	*300.00*	*0.00*	*0.00*	*0.00*	*0.00*	*300.00*
AF 015205000550 Office Trailer, furnished, rent per month, 50' x 12', excl. hookups	36.00	MO	0	0	10,800	0	0	0	0	10,800
			0.00	*0.00*	*0.00*	*400.00*	*0.00*	*0.00*	*0.00*	*400.00*
USR Utility Costs	36.00	MO	0	0	0	14,400	0	0	0	14,400
(Note: Include Electric, Phone, Fax and Supplies)										
USR Mob and Demob Office Trailer	1.00	LS	0	0	0	1,200	0	0	0	1,200
			465.92	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*	*224.95*	*790.87*
USR Janitorial	36.00	MO	16,773	0	3,600	0	0	0	8,098	28,471
Submittals	**1.00**	**LS**	**18,664**	**0**	**10,000**	**0**	**0**	**0**	**9,444**	**38,107**
USR Reproduction and Mail	1.00	LS	0	0	10,000	0	0	0	0	10,000
			622.12	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*314.79*	*936.91*
USR Initial Project Submittals	30.00	DAY	18,664	0	0	0	0	0	9,444	28,107
Mob and Demob	**1.00**	**LS**	**47,430**	**78,711**	**0**	**0**	**0**	**0**	**20,573**	**146,715**
(Note: Assume 3 days initial mob + 2 days demob year 1 + 2 days mob year 2 + 2 days demob year 2 + year 3 (11 days @ 12 hrs/day))										
			157.81	*343.66*	*0.00*	*0.00*	*0.00*	*0.00*	*67.18*	*568.65*
USR 1 tug + 4 barges + 1 Eng + 1 Oper + 2 Tug Workers	132.00	HR	20,831	45,363	0	0	0	0	8,868	75,061
			201.51	*252.64*	*0.00*	*0.00*	*0.00*	*0.00*	*88.68*	*542.83*
USR 1 Spud Barge + 1 Crane + 1 tug + 2 Oper + 2 Deck	132.00	HR	26,599	33,349	0	0	0	0	11,705	71,653
			442,828.80	*166,162.56*	*7,200.00*	*0.00*			*213,406.10*	*829,597.46*
Quality Control On-Site	**1.00**	**EA**	**442,829**	**166,163**	**7,200**	**0**	**0**	**0**	**213,406**	**829,597**
			12,300.80	*4,615.63*	*200.00*	*0.00*	*0.00*	*0.00*	*5,927.95*	*23,044.37*
USR Quality Control	36.00	MO	442,829	166,163	7,200	0	0	0	213,406	829,597

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			1,059.40	*1,144.14*	*10,284.46*	*0.00*			*468.55*	*13,997.97*
PZC 13 Combi-wall	**4,400.00**	**LF**	**4,661,371**	**5,034,226**	**45,251,622**	**0**	**4,582,233**	**0**	**2,061,605**	**61,591,056**
(Note: Beam - W40 x 167 @ 5.79 centers @ 68 feet long. Attached to the beams are connnectors welded to the beam for the PZC13 to insert into. PZC 13 @ 103 foot lengths.)										
			6.15	*4.96*	*202.43*	*0.00*			*2.74*	*216.27*
C King Pile (Beam)	**103,350.60**	**LF**	**635,716**	**512,365**	**20,921,004**	**0**	**0**	**0**	**282,811**	**22,351,896**
(Note: Includes BBS-M and BBS-F King piles are 68 feet in length. Lengths are on the high end for transportation purposes. From Civil/Structural Design assume that the lengths can be made and delivered without any splicing required at this point in the study.)										
			0.00	*0.00*	*2,165.00*	*0.00*	*0.00*	*0.00*	*0.00*	*2,165.00*
USR Material Price King Pile & connectors	9,663.28	TON	0	0	20,921,004	0	0	0	0	20,921,004
(Note: Connectors welded to pile.)										
			6.15	*4.96*	*0.00*	*0.00*	*0.00*	*0.00*	*2.74*	*13.85*
USR King pile installation	103,350.60	LF	635,716	512,365	0	0	0	0	282,811	1,430,892
(Note: Say 1 pile at 66 ft per hour due to tolerances.)										
			172.75	*139.23*	*2,035.00*	*0.00*			*76.85*	*2,423.84*
C PZC 13	**7,891.00**	**TON**	**1,363,195**	**1,098,688**	**16,058,185**	**0**	**0**	**0**	**606,445**	**19,126,513**
(Note: SSP piles are 103 feet in length. Lengths are on the high end for transportation purposes. From Civil/Structural Design assume that the lengths can be made and delivered without any splicing required at this point in the study.)										
			172.75	*139.23*	*0.00*	*0.00*	*0.00*	*0.00*	*76.85*	*388.84*
USR Steel Sheet Pile Installation	7,891.00	TON	1,363,195	1,098,688	0	0	0	0	606,445	3,068,328
			0.00	*0.00*	*2,035.00*	*0.00*	*0.00*	*0.00*	*0.00*	*2,035.00*
USR Material Price SSP	7,891.00	TON	0	0	16,058,185	0	0	0	0	16,058,185
			1,408.84	*1,162.94*	*6,500.00*	*0.00*			*631.22*	*9,703.00*
C Tie Rods	**380.00**	**EA**	**535,359**	**441,918**	**2,470,000**	**0**	**0**	**0**	**239,862**	**3,687,140**
			0.87	*0.72*	*4.00*	*0.00*	*0.00*	*0.00*	*0.39*	*5.97*
USR Wale & Tie Rod installation	617,500.00	LB	535,359	441,918	2,470,000	0	0	0	239,862	3,687,140
(Note: Reviewed the Chicago Shoreline beach job and price quote for wales @ $1.38/lb. Update due to current rates Use $2.00/lb ADJUST PRICE OF TIE RODS (DOUBLE THAT OF WALES).)										
			0.87	*0.72*	*2.00*	*0.00*			*0.39*	*3.97*
C Wales	**1,152,801.52**	**LB**	**999,454**	**825,010**	**2,305,603**	**0**	**0**	**0**	**447,795**	**4,577,863**
			0.87	*0.72*	*2.00*	*0.00*	*0.00*	*0.00*	*0.39*	*3.97*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
USR Wale & Tie Rod installation	1,152,801.52	LB	999,454	825,010	2,305,603	0	0	0	447,795	4,577,863
(Note: Reviewed the Chicago Shoreline beach job and price quote for wales @ $1.38/lb. Update due to current rates Use $2.00/lb)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*432.60*
C Concrete Cap	**10,592.31**	**CY**	**0**	**0**	**0**	**0**	**4,582,233**	**0**	**0**	**4,582,233**
			0.00	*0.00*	*0.00*	*0.00*	*412.00*	*0.00*	*0.00*	*412.00*
USR Concrete Cap	11,121.93	CY	0	0	0	0	4,582,233	0	0	4,582,233
(Note: From Chicago Shoreline 40-41 beach estimate approx. $400/cy Updated using ENR June 08 - June 07 = 1.03 = $412/cy (includes reinforcing and formwork). Add 5% to Qty for waste. Leave contractor unassigned as bid abstract price includes OH & Profit.)										
			2.46	*4.70*	*7.63*	*0.00*			*1.06*	*15.85*
Granular Fill	**458,300.00**	**TON**	**1,127,646**	**2,156,245**	**3,496,829**	**0**	**0**	**0**	**484,692**	**7,265,412**
(Note: Use Type D material.)										
			0.71	*0.89*	*7.63*	*0.00*	*0.00*	*0.00*	*0.31*	*9.53*
USR Type D Stone	458,300.00	TON	324,042	406,264	3,496,829	0	0	0	142,597	4,369,733
(Note: (4" Minus) ODOT 703.19A Crushed Ag clev e brkwtr 30/ton)										
			1.75	*3.82*	*0.00*	*0.00*	*0.00*	*0.00*	*0.75*	*6.32*
USR Haul from Sandusky	458,300.00	TON	803,604	1,749,980	0	0	0	0	342,095	2,895,679
(Note: 2400 tons per trip, 24 hrs per trip)										
Wier Structure & Walkway	**1.00**	**LS**	**0**	**0**	**0**	**0**	**115,000**	**0**	**0**	**115,000**
USR Wier Structure & Walkway	1.00	LS	0	0	0	0	115,000	0	0	115,000
(Note: Assume this wier to be constructed to handle future expansion of the CDF. From Cleveland 10b adjusted to current price levels. Leave contractor unassigned as bid abstract contains OH & P)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*35,000.00*
Fish Removal	**1.00**	**EA**	**0**	**0**	**0**	**0**	**35,000**	**0**	**0**	**35,000**
USR Fish Removal	1.00	LS	0	0	0	0	35,000	0	0	35,000
(Note: From Cleveland 10 B.)										
			3.28	*5.73*	*57.25*	*0.00*			*1.48*	*67.74*
Type A	**42,780.00**	**TON**	**140,320**	**245,230**	**2,449,155**	**0**	**0**	**0**	**63,282**	**2,897,988**
			1.53	*1.91*	*57.25*	*0.00*	*0.00*	*0.00*	*0.67*	*61.36*
USR Type A Armor Stone (5 ton to 10 ton)	42,780.00	TON	65,308	81,879	2,449,155	0	0	0	28,739	2,625,080
			1.75	*3.82*	*0.00*	*0.00*	*0.00*	*0.00*	*0.81*	*6.38*
USR Haul from Sandusky	42,780.00	TON	75,012	163,352	0	0	0	0	34,543	272,907

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
(Note: 2400 tons per cycle, 24 hrs per cycle)										
			2.94	*5.30*	*52.32*	*0.00*			*1.33*	*61.89*
Type B	**39,060.00**	**TON**	**114,789**	**207,195**	**2,043,619**	**0**	**0**	**0**	**51,914**	**2,417,518**
			1.19	*1.49*	*52.32*	*0.00*	*0.00*	*0.00*	*0.52*	*55.51*
USR Type B Stone (600 lb to 2000 lb) Placed for CDF	39,060.00	TON	46,300	58,048	2,043,619	0	0	0	20,375	2,168,342
			1.75	*3.82*	*0.00*	*0.00*	*0.00*	*0.00*	*0.81*	*6.38*
USR Haul from Sandusky	39,060.00	TON	68,490	149,147	0	0	0	0	31,539	249,176
(Note: 2400 tons per cycle, 24 hrs per cycle)										
			2.54	*4.81*	*26.71*	*0.00*			*1.16*	*35.22*
Type C	**111,345.00**	**TON**	**283,226**	**535,477**	**2,974,025**	**0**	**0**	**0**	**128,627**	**3,921,354**
			0.79	*0.99*	*26.71*	*0.00*	*0.00*	*0.00*	*0.35*	*28.84*
USR Type C Stone	111,345.00	TON	87,989	110,315	2,974,025	0	0	0	38,720	3,211,049
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)										
			1.75	*3.82*	*0.00*	*0.00*	*0.00*	*0.00*	*0.81*	*6.38*
USR Haul from Sandusky	111,345.00	TON	195,237	425,162	0	0	0	0	89,907	710,306
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.46	*4.70*	*7.63*	*0.00*			*1.12*	*15.91*
Type D	**37,050.00**	**TON**	**91,161**	**174,316**	**282,692**	**0**	**0**	**0**	**41,444**	**589,613**
			0.71	*0.89*	*7.63*	*0.00*	*0.00*	*0.00*	*0.31*	*9.53*
USR Type D Stone	37,050.00	TON	26,196	32,843	282,692	0	0	0	11,528	353,259
(Note: (4" Minus) ODOT 703.19A Crushed Ag clev e brkwtr 30/ton)										
			1.75	*3.82*	*0.00*	*0.00*	*0.00*	*0.00*	*0.81*	*6.38*
USR Haul from Sandusky	37,050.00	TON	64,965	141,472	0	0	0	0	29,916	236,354
(Note: 2400 tons per trip, 24 hrs per trip)										
			9.53	*18.16*	*48.37*	*0.00*			*4.16*	*80.21*
Type E	**34,600.00**	**TON**	**329,632**	**628,416**	**1,673,432**	**0**	**0**	**0**	**143,825**	**2,775,305**
			0.79	*0.99*	*26.71*	*0.00*	*0.00*	*0.00*	*0.35*	*28.84*
USR Type C and E Stone	34,600.00	TON	27,342	34,280	924,166	0	0	0	12,032	997,820
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)										
			1.75	*3.82*	*0.00*	*0.00*	*0.00*	*0.00*	*0.81*	*6.38*
USR Haul from Sandusky	34,600.00	TON	60,669	132,117	0	0	0	0	27,938	220,725
(Note: 2400 tons per trip, 24 hrs per trip)										

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			2.46	*4.70*	*7.63*	*0.00*			*1.06*	*15.85*
Type D	**98,200.00**	**TON**	**241,621**	**462,019**	**749,266**	**0**	**0**	**0**	**103,855**	**1,556,761**
			0.71	*0.89*	*7.63*	*0.00*	*0.00*	*0.00*	*0.31*	*9.53*
USR Type D Stone	98,200.00	TON	69,433	87,050	749,266	0	0	0	30,554	936,303
(Note: (4" Minus) ODOT 703.19A Crushed Ag clev e brkwtr 30/ton)										
			1.75	*3.82*	*0.00*	*0.00*	*0.00*	*0.00*	*0.75*	*6.32*
USR Haul from Sandusky	98,200.00	TON	172,188	374,969	0	0	0	0	73,301	620,458
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.43	*4.66*	*7.63*	*0.00*			*1.10*	*15.82*
Type F	**1,860.00**	**TON**	**4,511**	**8,669**	**14,192**	**0**	**0**	**0**	**2,052**	**29,423**
			0.67	*0.84*	*7.63*	*0.00*	*0.00*	*0.00*	*0.30*	*9.44*
USR Type F Stone	1,860.00	TON	1,249	1,566	14,192	0	0	0	550	17,557
(Note: (3/4" to 1") ODOT 703.01 Size No. 68 clev e brkwtr 20/ton)										
			1.75	*3.82*	*0.00*	*0.00*	*0.00*	*0.00*	*0.81*	*6.38*
USR Haul from Sandusky	1,860.00	TON	3,261	7,102	0	0	0	0	1,502	11,866
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.69	*4.99*	*33.35*	*0.00*			*1.22*	*42.25*
Type H	**61,300.00**	**TON**	**164,940**	**306,101**	**2,044,355**	**0**	**0**	**0**	**74,780**	**2,590,176**
			0.94	*1.18*	*33.35*	*0.00*	*0.00*	*0.00*	*0.41*	*35.87*
USR Type H Stone	61,300.00	TON	57,454	72,032	2,044,355	0	0	0	25,283	2,199,124
(Note: (6" - 18") ODOT 703.19B Type C)										
			1.75	*3.82*	*0.00*	*0.00*	*0.00*	*0.00*	*0.81*	*6.38*
USR Haul from Sandusky	61,300.00	TON	107,486	234,069	0	0	0	0	49,497	391,052
(Note: 2400 tons per trip, 24 hrs per trip)										
Mitagation	**1.00**	**LS**	**0**	**0**	**0**	**0**	**0**	**250,000**	**0**	**250,000**
USR Mitagation	1.00	LS	0	0	0	0	0	250,000	0	250,000
(Note: Per PM Mitagation costs from Friends of Chicago River project escalated to the scope of this project. Leave contractor unassigned.)										
Cell 2	**1.00**	**LS**	**6,293,976**	**10,818,787**	**73,607,457**	**15,600**	**0**	**250,000**	**2,858,792**	**93,844,612**
			525,695.76	*244,873.95*	*31,600.00*	*15,600.00*			*251,520.80*	*1,069,290.51*
General Conditions	**1.00**	**EA**	**525,696**	**244,874**	**31,600**	**15,600**	**0**	**0**	**251,521**	**1,069,291**
			16,773.12	*0.00*	*14,400.00*	*15,600.00*			*8,098.03*	*54,871.15*
Temporary Office	**1.00**	**EA**	**16,773**	**0**	**14,400**	**15,600**	**0**	**0**	**8,098**	**54,871**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			0.00	*0.00*	*300.00*	*0.00*	*0.00*	*0.00*	*0.00*	*300.00*
AF 015205000550 Office Trailer, furnished, rent per month, 50' x 12', excl. hookups	36.00	MO	0	0	10,800	0	0	0	0	10,800
			0.00	*0.00*	*0.00*	*400.00*	*0.00*	*0.00*	*0.00*	*400.00*
USR Utility Costs	36.00	MO	0	0	0	14,400	0	0	0	14,400
(Note: Include Electric, Phone, Fax and Supplies)										
USR Mob and Demob Office Trailer	1.00	LS	0	0	0	1,200	0	0	0	1,200
			465.92	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*	*224.95*	*790.87*
USR Janitorial	36.00	MO	16,773	0	3,600	0	0	0	8,098	28,471
Submittals	**1.00**	**LS**	**18,664**	**0**	**10,000**	**0**	**0**	**0**	**9,444**	**38,107**
USR Reproduction and Mail	1.00	LS	0	0	10,000	0	0	0	0	10,000
			622.12	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*314.79*	*936.91*
USR Initial Project Submittals	30.00	DAY	18,664	0	0	0	0	0	9,444	28,107
Mob and Demob	**1.00**	**LS**	**47,430**	**78,711**	**0**	**0**	**0**	**0**	**20,573**	**146,715**
(Note: Assume 3 days initial mob + 2 days demob year 1 + 2 days mob year 2 + 2 days demob year 2 + year 3 (11 days @ 12 hrs/day))										
			157.81	*343.66*	*0.00*	*0.00*	*0.00*	*0.00*	*67.18*	*568.65*
USR 1 tug + 4 barges + 1 Eng + 1 Oper + 2 Tug Workers	132.00	HR	20,831	45,363	0	0	0	0	8,868	75,061
			201.51	*252.64*	*0.00*	*0.00*	*0.00*	*0.00*	*88.68*	*542.83*
USR 1 Spud Barge + 1 Crane + 1 tug + 2 Oper + 2 Deck	132.00	HR	26,599	33,349	0	0	0	0	11,705	71,653
			442,828.80	*166,162.56*	*7,200.00*	*0.00*			*213,406.10*	*829,597.46*
Quality Control On-Site	**1.00**	**EA**	**442,829**	**166,163**	**7,200**	**0**	**0**	**0**	**213,406**	**829,597**
			12,300.80	*4,615.63*	*200.00*	*0.00*	*0.00*	*0.00*	*5,927.95*	*23,044.37*
USR Quality Control	36.00	MO	442,829	166,163	7,200	0	0	0	213,406	829,597
			3.28	*5.73*	*57.25*	*0.00*			*1.48*	*67.74*
Type A	**336,310.00**	**TON**	**1,103,109**	**1,927,851**	**19,253,748**	**0**	**0**	**0**	**497,486**	**22,782,193**
			1.53	*1.91*	*57.25*	*0.00*	*0.00*	*0.00*	*0.67*	*61.36*
USR Type A Armor Stone (5 ton to 10 ton)	336,310.00	TON	513,408	643,679	19,253,748	0	0	0	225,929	20,636,763
			1.75	*3.82*	*0.00*	*0.00*	*0.00*	*0.00*	*0.81*	*6.38*
USR Haul from Sandusky	336,310.00	TON	589,701	1,284,172	0	0	0	0	271,557	2,145,430
(Note: 2400 tons per cycle, 24 hrs per cycle)										

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			2.94	*5.30*	*52.32*	*0.00*			*1.33*	*61.89*
Type B	**336,400.00**	**TON**	**988,611**	**1,784,447**	**17,600,448**	**0**	**0**	**0**	**447,104**	**20,820,610**
			1.19	*1.49*	*52.32*	*0.00*	*0.00*	*0.00*	*0.52*	*55.51*
USR Type B Stone (600 lb to 2000 lb) Placed for CDF	336,400.00	TON	398,753	499,932	17,600,448	0	0	0	175,474	18,674,606
			1.75	*3.82*	*0.00*	*0.00*	*0.00*	*0.00*	*0.81*	*6.38*
USR Haul from Sandusky	336,400.00	TON	589,859	1,284,515	0	0	0	0	271,630	2,146,004
(Note: 2400 tons per cycle, 24 hrs per cycle)										
			2.54	*4.81*	*26.71*	*0.00*			*1.16*	*35.22*
Type C	**938,800.00**	**TON**	**2,388,007**	**4,514,844**	**25,075,348**	**0**	**0**	**0**	**1,084,511**	**33,062,710**
			0.79	*0.99*	*26.71*	*0.00*	*0.00*	*0.00*	*0.35*	*28.84*
USR Type C Stone	938,800.00	TON	741,873	930,115	25,075,348	0	0	0	326,467	27,073,802
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)										
			1.75	*3.82*	*0.00*	*0.00*	*0.00*	*0.00*	*0.81*	*6.38*
USR Haul from Sandusky	938,800.00	TON	1,646,134	3,584,730	0	0	0	0	758,044	5,988,908
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.46	*4.70*	*7.63*	*0.00*			*1.12*	*15.91*
Type D	**37,100.00**	**TON**	**91,284**	**174,551**	**283,073**	**0**	**0**	**0**	**41,500**	**590,409**
			0.71	*0.89*	*7.63*	*0.00*	*0.00*	*0.00*	*0.31*	*9.53*
USR Type D Stone	37,100.00	TON	26,232	32,888	283,073	0	0	0	11,543	353,736
(Note: (4" Minus) ODOT 703.19A Crushed Ag clev e brkwtr 30/ton)										
			1.75	*3.82*	*0.00*	*0.00*	*0.00*	*0.00*	*0.81*	*6.38*
USR Haul from Sandusky	37,100.00	TON	65,053	141,663	0	0	0	0	29,957	236,673
(Note: 2400 tons per trip, 24 hrs per trip)										
			3.52	*6.68*	*29.74*	*0.00*			*1.58*	*41.52*
Type E	**247,200.00**	**TON**	**870,418**	**1,650,844**	**7,351,978**	**0**	**0**	**0**	**389,423**	**10,262,664**
			0.79	*0.99*	*26.71*	*0.00*	*0.00*	*0.00*	*0.35*	*28.84*
USR Type C and E Stone	247,200.00	TON	195,346	244,913	6,602,712	0	0	0	85,964	7,128,935
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)										
			1.75	*3.82*	*0.00*	*0.00*	*0.00*	*0.00*	*0.81*	*6.38*
USR Haul from Sandusky	247,200.00	TON	433,451	943,913	0	0	0	0	199,604	1,576,968
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.46	*4.70*	*7.63*	*0.00*			*1.06*	*15.85*
Type D	**98,200.00**	**TON**	**241,621**	**462,019**	**749,266**	**0**	**0**	**0**	**103,855**	**1,556,761**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			0.71	*0.89*	*7.63*	*0.00*	*0.00*	*0.00*	*0.31*	*9.53*
USR Type D Stone	98,200.00	TON	69,433	87,050	749,266	0	0	0	30,554	936,303
(Note: (4" Minus) ODOT 703.19A Crushed Ag clev e brkwtr 30/ton)										
			1.75	*3.82*	*0.00*	*0.00*	*0.00*	*0.00*	*0.75*	*6.32*
USR Haul from Sandusky	98,200.00	TON	172,188	374,969	0	0	0	0	73,301	620,458
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.43	*4.66*	*7.63*	*0.00*			*1.10*	*15.82*
Type F	**43,700.00**	**TON**	**105,979**	**203,666**	**333,431**	**0**	**0**	**0**	**48,203**	**691,279**
			0.67	*0.84*	*7.63*	*0.00*	*0.00*	*0.00*	*0.30*	*9.44*
USR Type F Stone	43,700.00	TON	29,353	36,801	333,431	0	0	0	12,917	412,503
(Note: (3/4" to 1") ODOT 703.01 Size No. 68 clev e brkwtr 20/ton)										
			1.75	*3.82*	*0.00*	*0.00*	*0.00*	*0.00*	*0.81*	*6.38*
USR Haul from Sandusky	43,700.00	TON	76,626	166,865	0	0	0	0	35,286	278,776
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.69	*4.99*	*33.35*	*0.00*			*1.22*	*42.25*
Type H	**7,700.00**	**TON**	**20,718**	**38,450**	**256,795**	**0**	**0**	**0**	**9,393**	**325,357**
			0.94	*1.18*	*33.35*	*0.00*	*0.00*	*0.00*	*0.41*	*35.87*
USR Type H Stone	7,700.00	TON	7,217	9,048	256,795	0	0	0	3,176	276,236
(Note: (6" - 18") ODOT 703.19B Type C)										
			1.75	*3.82*	*0.00*	*0.00*	*0.00*	*0.00*	*0.81*	*6.38*
USR Haul from Sandusky	7,700.00	TON	13,502	29,402	0	0	0	0	6,217	49,121
(Note: 2400 tons per trip, 24 hrs per trip)										
			16,530.73	*14,194.07*	*4,036.50*	*0.00*			*7,217.36*	*41,978.66*
Weir and Walkway	**1.00**	**EA**	**16,531**	**14,194**	**4,037**	**0**	**0**	**0**	**7,217**	**41,979**
(Note: Quantities obtained from Dike 10b IGE dated June 1996)										
			15,072.96	*14,111.92*	*1,420.50*	*0.00*			*6,589.84*	*37,195.22*
Wier	**1.00**	**EA**	**15,073**	**14,112**	**1,421**	**0**	**0**	**0**	**6,590**	**37,195**
			16.75	*15.68*	*0.70*	*0.00*	*0.00*	*0.00*	*7.32*	*40.45*
MIL 031104300150 C.I.P. concrete forms, footing, continuous wall, plywood, 4 use, includes erecting, bracing, stripping and cleaning	300.00	SFC	5,024	4,704	210	0	0	0	2,197	12,135
			2,512.16	*2,351.99*	*541.50*	*0.00*	*0.00*	*0.00*	*1,098.31*	*6,503.95*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
MIL 032106000700 Reinforcing steel, in place, walls, #3 to #7, A615, grade 60	1.00	TON	2,512	2,352	542	0	0	0	1,098	6,504
			418.69	*392.00*	*0.00*	*0.00*	*0.00*	*0.00*	*183.05*	*993.74*
USR 033107005400 Structural concrete, placing, walls, with crane and bucket, 15" thick, includes vibrating, excludes material	6.00	CY	2,512	2,352	0	0	0	0	1,098	5,962
			0.00	*0.00*	*110.00*	*0.00*	*0.00*	*0.00*	*0.00*	*110.00*
MIL 033102200300 Structural concrete, ready mix, normal weight, 4000 PSI, includes material only	6.00	CY	0	0	660	0	0	0	0	660
			16.75	*15.68*	*0.03*	*0.00*	*0.00*	*0.00*	*7.32*	*39.78*
MIL 033503500010 Concrete finishing, walls, includes breaking ties and patching voids	300.00	SF	5,024	4,704	9	0	0	0	2,197	11,934
			1,457.77	*82.15*	*2,616.00*	*0.00*			*627.51*	*4,783.44*
Walkway, Railing and Ladder	**1.00**	**EA**	**1,458**	**82**	**2,616**	**0**	**0**	**0**	**628**	**4,783**
			9.02	*0.45*	*19.75*	*0.00*	*0.00*	*0.00*	*3.88*	*33.10*
RSM 055207000020 Railing, pipe, aluminum, satin finish, 2 rails, 1-1/4" dia	20.00	LF	180	9	395	0	0	0	78	662
			2.41	*0.12*	*10.70*	*0.00*	*0.00*	*0.00*	*1.04*	*14.26*
MIL 055303400694 Floor grating, steel, galvanized, 1-1/4" x 3/16" bearing bars @ 15/16" O.C., cross bars @ 4" O.C., 9.1 #/S.F., up to 300 S.F.	100.00	SF	241	12	1,070	0	0	0	104	1,426
			30.18	*1.99*	*6.55*	*0.00*	*0.00*	*0.00*	*13.00*	*51.73*
MIL 051204400672 Channel framing, structural steel, field fabricated, C8x11.5, incl cutting & welding	20.00	LF	604	40	131	0	0	0	260	1,035
			28.87	*1.43*	*68.00*	*0.00*	*0.00*	*0.00*	*12.42*	*110.72*
MIL 055145000020 Ladder, steel, 20" W, bolted to concrete, incl cage	15.00	VLF	433	21	1,020	0	0	0	186	1,661

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			91.35	*131.87*	*1,700.00*	*0.00*			*41.01*	*1,964.24*
Steel Sheet Pile Wall	**2,010.00**	**TON**	**183,623**	**265,065**	**3,417,000**	**0**	**0**	**0**	**82,434**	**3,948,122**
			91.35	*131.87*	*1,700.00*	*0.00*			*41.01*	*1,964.24*
CZ67	**2,010.00**	**TON**	**183,623**	**265,065**	**3,417,000**	**0**	**0**	**0**	**82,434**	**3,948,122**
			91.35	*131.87*	*1,700.00*	*0.00*	*0.00*	*0.00*	*41.01*	*1,964.24*
USR Marine Sheet piling, steel, 38 psf, 40' excavation, left in place, excludes wales	2,010.00	TON	183,623	265,065	3,417,000	0	0	0	82,434	3,948,122
(Note: Modified for Marine Plant. Sttel Sheet Pile price adjusted from $816.21 ton to more current prices of $1700/ton)										
Mitagation	**1.00**	**LS**	**0**	**0**	**0**	**0**	**0**	**250,000**	**0**	**250,000**
USR Mitagation	1.00	LS	0	0	0	0	0	250,000	0	250,000
(Note: Per PM Mitagation costs from Friends of Chicago River project escalated to the scope of this project. Leave contractor unassigned.)										

Description **Page**

Description **Page**

Description **Page**

Site 3A - 20 year Capacity
Site 3A - 20 Year Capacity
Revised estimate include new labor rates and esculated stone price quotes to current (4th Qtr FY08) dollars.
Estimate NOT escaluated to Future $$.
March 2009 Mitagation measures added

Estimated by	JW
Designed by	Reed Vetovitz
Prepared by	James Wryk
Preparation Date	8/20/2008
Effective Date of Pricing	8/20/2008
Estimated Construction Time	Days

Date	Author	Note
8/24/2006	JSD	Quotes for stone materials received from Marblehead Quarries, LaFarge Corporation on August 24, 2006. Allen Boros, Territory Manager. 419-290-5076. All prices are FOB Contractor's barge. Does not include any transportation charges.
8/24/2006	JSD	According to Mr. Boros the reason for the high unit price for Armor Stone for Alternatives #2 and #3 are because the quarry will have to set-up of a new production area so as not to interfere with normal quarry production operations. Mr. Boros estimated that annual production of Type A stone would be between 80,000 tons and 100,000 tons.
8/25/2006	JSD	Quantities of materials were based on design documents provided by designer. Designer provided the in-place volumes and conversion factors for determining quantities of stone.
8/28/2006	jsd	15% contingency has been added to this estimate. In addition the price quote from the quarry is on the conservative side not only because of the opening of a new section of quarry but for the uncertainties in the design at the time of the price quote.
7/18/2008	jw	This file contain revisions to bring the estimate up to current prices. Material price quotes have been escalated to current pricing, labor and equipment rates have been checked.
8/26/2008	jw	Site 3A is on the Western edge of the breakwater from the arrowhead going east.. Site 3A is straddling both sides of the breakwater with Cell 1(Harbor Side) constructed of SSP wall with King Piles and Cell 2 on the Lake side being constructed out of Stone.
9/8/2008	jw	Revised estimate include new labor rates and escalated stone price quotes to current (4th Qtr FY08) dollars. Estimate NOT escaluated to Future $$.
9/9/2008	jw	Estimate broken into 2 cells. Because the cells may be completed by different contracts, Mob/Demob, Wier Structure and fish removal is added to both cells of the estimate.
12/29/2008	jw	Contingencies updated based on Cost Risk Analysis worked up by Walla Walla District. Equipment Rates updated to latest database Labor Rates updated to latest labor rates

Description	Quantity	UOM	ContractCost	Contingency	ProjectCost
Project Cost Summary Report			**274,436,766**	**66,402,272**	**340,839,038**
Cell 1	**1.00**	**LS**	**111,960,023**	**27,078,509**	**139,038,532**
General Conditions	**1.00**	**LS**	**1,328,373**	**321,997**	**1,650,370**
Temporary Office	**1.00**	**LS**	**67,870**	**16,452**	**84,321**
Submittals	**1.00**	**LS**	**49,555**	**12,012**	**61,567**
Mob and Demob	**1.00**	**LS**	**185,452**	**44,953**	**230,405**
Quality Control On-Site	**1.00**	**LS**	**1,025,496**	**248,580**	**1,274,077**
CZ67	**703.00**	**TON**	*2,556.16* **1,796,983**	**435,589**	*3,175.78* **2,232,572**
Wier Structure & Walkway	**1.00**	**LS**	**142,243**	**34,480**	**176,722**
Fish Removal	**1.00**	**LS**	**43,291**	**10,494**	**53,785**
Type A	**78,430.00**	**TON**	*83.93* **6,582,566**	**1,595,614**	*104.27* **8,178,180**
Type B	**53,382.00**	**TON**	*76.67* **4,092,960**	**992,133**	*95.26* **5,085,093**
Type C	**152,172.00**	**TON**	*43.66* **6,643,075**	**1,610,281**	*54.24* **8,253,356**
Type D	**50,635.00**	**TON**	*19.77* **1,001,195**	**242,690**	*24.57* **1,243,884**
Type E	**47,281.00**	**TON**	*43.66* **2,064,054**	**500,327**	*54.24* **2,564,381**
Type F	**2,542.00**	**TON**	*19.65* **49,957**	**12,110**	*24.42* **62,067**
Type H	**83,886.00**	**TON**	*52.37* **4,392,862**	**1,064,830**	*65.06* **5,457,692**
PZC 13 Combi-wall	**4,500.00**	**LF**	*18,571.66* **83,572,464**	**20,257,965**	*23,073.43* **103,830,429**
C King Pile (Beam)	**105,672.00**	**LF**	*267.70* **28,288,215**	**6,857,063**	*332.59* **35,145,278**
C PZC 13	**9,880.00**	**TON**	*3,003.67* **29,676,240**	**7,193,521**	*3,731.76* **36,869,760**

Description	Quantity	UOM	ContractCost	Contingency	ProjectCost
C Tie Rods	**389.00**	**EA**	*12,045.27* **4,685,611**	**1,135,792**	*14,965.05* **5,821,403**
C Wales	**1,179,001.56**	**LB**	*4.94* **5,822,723**	**1,411,428**	*6.14* **7,234,152**
Granular Fill	**468,720.00**	**TON**	*19.85* **9,303,131**	**2,255,079**	*24.66* **11,558,210**
C Concrete Cap	**10,833.04**	**CY**	*535.08* **5,796,544**	**1,405,082**	*664.78* **7,201,626**
Mitagation	**1.00**	**LS**	**250,000**	**0**	**250,000**
Cell 2	**1.00**	**LS**	**162,476,744**	**39,323,763**	**201,800,506**
General Conditions	**1.00**	**LS**	**1,328,373**	**321,997**	**1,650,370**
Temporary Office	**1.00**	**LS**	**67,870**	**16,452**	**84,321**
Submittals	**1.00**	**LS**	**49,555**	**12,012**	**61,567**
Mob and Demob	**1.00**	**LS**	**185,452**	**44,953**	**230,405**
Quality Control On-Site	**1.00**	**LS**	**1,025,496**	**248,580**	**1,274,077**
Type A	**446,199.00**	**TON**	*84.75* **37,814,636**	**9,166,268**	*105.29* **46,980,904**
Type B	**479,241.00**	**TON**	*77.49* **37,137,443**	**9,002,116**	*96.28* **46,139,559**
Type C	**1,243,648.00**	**TON**	*44.47* **55,310,274**	**13,407,210**	*55.25* **68,717,485**
Type D	**47,522.00**	**TON**	*20.59* **978,571**	**237,206**	*25.58* **1,215,776**
Type E	**323,144.00**	**TON**	*44.47* **14,371,577**	**3,483,670**	*55.25* **17,855,248**
Type F	**566,840.00**	**TON**	*20.47* **11,604,324**	**2,812,888**	*25.43* **14,417,212**
Type H	**7,642.00**	**TON**	*53.19* **406,449**	**98,523**	*66.08* **504,972**
Weir and Walkway	**1.00**	**LS**	**52,562**	**12,741**	**65,303**
Wier	**1.00**	**EA**	*46,651.03* **46,651**	**11,308**	*57,959.24* **57,959**

Description	Quantity	UOM	ContractCost	Contingency	ProjectCost
			5,910.58		*7,343.31*
Walkway, Railing and Ladder	**1.00**	**EA**	**5,911**	**1,433**	**7,343**
			2,432.47		*3,022.11*
CZ67	**1,307.00**	**TON**	**3,179,244**	**770,649**	**3,949,893**
Fish Removal	**1.00**	**LS**	**43,291**	**10,494**	**53,785**
Mitagation	**1.00**	**LS**	**250,000**	**0**	**250,000**

Description	Quantity	UOM	DirectCost	SubCMU	PrimeCMU	ContractCost
Contract Cost Summary Report			**219,909,195**	**4,732,986**	**49,794,586**	**274,436,766**
Cell 1	**1.00**	**LS**	**90,565,040**	**0**	**21,394,983**	**111,960,023**
General Conditions	**1.00**	**LS**	**1,073,959**	**0**	**254,413**	**1,328,373**
Temporary Office	**1.00**	**LS**	**54,871**	**0**	**12,999**	**67,870**
Submittals	**1.00**	**LS**	**40,064**	**0**	**9,491**	**49,555**
Mob and Demob	**1.00**	**LS**	**149,933**	**0**	**35,518**	**185,452**
Quality Control On-Site	**1.00**	**LS**	**829,091**	**0**	**196,406**	**1,025,496**
CZ67	**703.00**	**TON**	*2,066.60* **1,452,821**	**0**	**344,163**	*2,556.16* **1,796,983**
Wier Structure & Walkway	**1.00**	**LS**	**115,000**	**0**	**27,243**	**142,243**
Fish Removal	**1.00**	**LS**	**35,000**	**0**	**8,291**	**43,291**
Type A	**78,430.00**	**TON**	*67.85* **5,321,857**	**0**	**1,260,710**	*83.93* **6,582,566**
Type B	**53,382.00**	**TON**	*61.99* **3,309,066**	**0**	**783,894**	*76.67* **4,092,960**
Type C	**152,172.00**	**TON**	*35.29* **5,370,777**	**0**	**1,272,298**	*43.66* **6,643,075**
Type D	**50,635.00**	**TON**	*15.99* **809,443**	**0**	**191,751**	*19.77* **1,001,195**
Type E	**47,281.00**	**TON**	*35.29* **1,668,741**	**0**	**395,313**	*43.66* **2,064,054**
Type F	**2,542.00**	**TON**	*15.89* **40,389**	**0**	**9,568**	*19.65* **49,957**
Type H	**83,886.00**	**TON**	*42.34* **3,551,530**	**0**	**841,332**	*52.37* **4,392,862**
PZC 13 Combi-wall	**4,500.00**	**LF**	*15,014.77* **67,566,457**	**0**	**16,006,007**	*18,571.66* **83,572,464**
C King Pile (Beam)	**105,672.00**	**LF**	*216.43* **22,870,385**	**0**	**5,417,830**	*267.70* **28,288,215**
C PZC 13	**9,880.00**	**TON**	*2,428.40* **23,992,572**	**0**	**5,683,668**	*3,003.67* **29,676,240**

Description	**Quantity**	**UOM**	**DirectCost**	**SubCMU**	**PrimeCMU**	**ContractCost**
C Tie Rods	**389.00**	**EA**	*9,738.33* **3,788,211**	**0**	**897,400**	*12,045.27* **4,685,611**
C Wales	**1,179,001.56**	**LB**	*3.99* **4,707,541**	**0**	**1,115,183**	*4.94* **5,822,723**
Granular Fill	**468,720.00**	**TON**	*16.05* **7,521,372**	**0**	**1,781,759**	*19.85* **9,303,131**
C Concrete Cap	**10,833.04**	**CY**	*432.60* **4,686,375**	**0**	**1,110,169**	*535.08* **5,796,544**
Mitagation	**1.00**	**LS**	**250,000**	**0**	**0**	**250,000**
Cell 2	**1.00**	**LS**	**129,344,155**	**4,732,986**	**28,399,603**	**162,476,744**
General Conditions	**1.00**	**LS**	**1,073,959**	**0**	**254,413**	**1,328,373**
Temporary Office	**1.00**	**LS**	**54,871**	**0**	**12,999**	**67,870**
Submittals	**1.00**	**LS**	**40,064**	**0**	**9,491**	**49,555**
Mob and Demob	**1.00**	**LS**	**149,933**	**0**	**35,518**	**185,452**
Quality Control On-Site	**1.00**	**LS**	**829,091**	**0**	**196,406**	**1,025,496**
Type A	**446,199.00**	**TON**	*67.85* **30,276,771**	**678,129**	**6,859,736**	*84.75* **37,814,636**
Type B	**479,241.00**	**TON**	*61.99* **29,707,392**	**728,346**	**6,701,705**	*77.49* **37,137,443**
Type C	**1,243,648.00**	**TON**	*35.29* **43,893,461**	**1,890,084**	**9,526,730**	*44.47* **55,310,274**
Type D	**47,522.00**	**TON**	*15.99* **759,679**	**72,223**	**146,668**	*20.59* **978,571**
Type E	**323,144.00**	**TON**	*35.29* **11,405,083**	**491,111**	**2,475,383**	*44.47* **14,371,577**
Type F	**566,840.00**	**TON**	*15.89* **9,006,424**	**861,478**	**1,736,422**	*20.47* **11,604,324**
Type H	**7,642.00**	**TON**	*42.34* **323,544**	**11,614**	**71,291**	*53.19* **406,449**
Weir and Walkway	**1.00**	**LS**	**42,495**	**0**	**10,067**	**52,562**
Wier	**1.00**	**EA**	*37,716.31* **37,716**	**0**	**8,935**	*46,651.03* **46,651**

Description	Quantity	UOM	DirectCost	SubCMU	PrimeCMU	ContractCost
			4,778.57			*5,910.58*
Walkway, Railing and Ladder	**1.00**	**EA**	**4,779**	**0**	**1,132**	**5,911**
			1,966.60			*2,432.47*
CZ67	**1,307.00**	**TON**	**2,570,348**	**0**	**608,897**	**3,179,244**
Fish Removal	**1.00**	**LS**	**35,000**	**0**	**8,291**	**43,291**
Mitagation	**1.00**	**LS**	**250,000**	**0**	**0**	**250,000**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
Project Direct Costs Report			**15,981,970**	**25,008,104**	**166,737,404**	**31,200**	**4,871,375**	**500,000**	**6,779,142**	**219,909,195**
Cell 1	**1.00**	**LS**	**6,949,487**	**8,393,169**	**67,069,629**	**15,600**	**4,836,375**	**250,000**	**3,050,780**	**90,565,040**
(Note: Inside of the current breakwall. Will contain a combi-wall system with a refurbished breakwater.)										
General Conditions	**1.00**	**LS**	**527,035**	**247,586**	**31,600**	**15,600**	**0**	**0**	**252,138**	**1,073,959**
Temporary Office	**1.00**	**LS**	**16,773**	**0**	**14,400**	**15,600**	**0**	**0**	**8,098**	**54,871**
			0.00	*0.00*	*300.00*	*0.00*	*0.00*	*0.00*	*0.00*	*300.00*
AF 015205000550 Office Trailer, furnished, rent per month, 50' x 12', excl. hookups	36.00	MO	0	0	10,800	0	0	0	0	10,800
			0.00	*0.00*	*0.00*	*400.00*	*0.00*	*0.00*	*0.00*	*400.00*
USR Utility Costs	36.00	MO	0	0	0	14,400	0	0	0	14,400
(Note: Include Electric, Phone, Fax and Supplies)										
USR Mob and Demob Office Trailer	1.00	LS	0	0	0	1,200	0	0	0	1,200
			465.92	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*	*224.95*	*790.87*
USR Janitorial	36.00	MO	16,773	0	3,600	0	0	0	8,098	28,471
Submittals	**1.00**	**LS**	**20,003**	**0**	**10,000**	**0**	**0**	**0**	**10,061**	**40,064**
USR Reproduction and Mail	1.00	LS	0	0	10,000	0	0	0	0	10,000
			666.76	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*335.37*	*1,002.13*
USR Initial Project Submittals	30.00	DAY	20,003	0	0	0	0	0	10,061	30,064
Mob and Demob	**1.00**	**LS**	**47,430**	**81,930**	**0**	**0**	**0**	**0**	**20,573**	**149,933**
(Note: Assume 3 days initial mob + 2 days demob year 1 + 2 days mob year 2 + 2 days demob year 2 + year 3 (11 days @ 12 hrs/day))										
			157.81	*357.88*	*0.00*	*0.00*	*0.00*	*0.00*	*67.18*	*582.87*
USR 1 tug + 4 barges + 1 Eng + 1 Oper + 2 Tug Workers	132.00	HR	20,831	47,240	0	0	0	0	8,868	76,938
			201.51	*262.81*	*0.00*	*0.00*	*0.00*	*0.00*	*88.68*	*552.99*
USR 1 Spud Barge + 1 Crane + 1 tug + 2 Oper + 2 Deck	132.00	HR	26,599	34,691	0	0	0	0	11,705	72,995
Quality Control On-Site	**1.00**	**LS**	**442,829**	**165,656**	**7,200**	**0**	**0**	**0**	**213,406**	**829,091**
			12,300.80	*4,601.55*	*200.00*	*0.00*	*0.00*	*0.00*	*5,927.95*	*23,030.30*
USR Quality Control	36.00	MO	442,829	165,656	7,200	0	0	0	213,406	829,091
			91.35	*134.23*	*1,800.00*	*0.00*			*41.01*	*2,066.60*
CZ67	**703.00**	**TON**	**64,222**	**94,367**	**1,265,400**	**0**	**0**	**0**	**28,831**	**1,452,821**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			91.35	*134.23*	*1,800.00*	*0.00*	*0.00*	*0.00*	*41.01*	*2,066.60*
USR Marine Sheet piling, steel, 38 psf, 40' excavation, left in place, excludes wales	703.00	TON	64,222	94,367	1,265,400	0	0	0	28,831	1,452,821
(Note: Modified for Marine Plant)										
Wier Structure & Walkway	**1.00**	**LS**	**0**	**0**	**0**	**0**	**115,000**	**0**	**0**	**115,000**
USR Wier Structure & Walkway	1.00	LS	0	0	0	0	115,000	0	0	115,000
(Note: Assume this wier to be constructed to handle future expansion of the CDF. From Cleveland 10b adjusted to current price levels. Leave contractor unassigned as bid abstract contains OH & P)										
Fish Removal	**1.00**	**LS**	**0**	**0**	**0**	**0**	**35,000**	**0**	**0**	**35,000**
USR Fish Removal	1.00	LS	0	0	0	0	35,000	0	0	35,000
(Note: From Cleveland 10 B.)										
			3.28	*5.97*	*57.25*	*0.00*			*1.36*	*67.85*
Type A	**78,430.00**	**TON**	**257,253**	**468,021**	**4,490,118**	**0**	**0**	**0**	**106,465**	**5,321,857**
			1.53	*1.99*	*57.25*	*0.00*	*0.00*	*0.00*	*0.67*	*61.44*
USR Type A Armor Stone (5 ton to 10 ton)	78,430.00	TON	119,731	156,151	4,490,118	0	0	0	52,688	4,818,688
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.69*	*6.42*
USR Haul from Sandusky	78,430.00	TON	137,523	311,870	0	0	0	0	53,777	503,169
(Note: 2400 tons per cycle, 24 hrs per cycle)										
			2.94	*5.52*	*52.32*	*0.00*			*1.21*	*61.99*
Type B	**53,382.00**	**TON**	**156,879**	**294,793**	**2,792,946**	**0**	**0**	**0**	**64,448**	**3,309,066**
			1.19	*1.55*	*52.32*	*0.00*	*0.00*	*0.00*	*0.52*	*55.57*
USR Type B Stone (600 lb to 2000 lb) Placed for CDF	53,382.00	TON	63,277	82,525	2,792,946	0	0	0	27,845	2,966,593
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.69*	*6.42*
USR Haul from Sandusky	53,382.00	TON	93,602	212,269	0	0	0	0	36,602	342,473
(Note: 2400 tons per cycle, 24 hrs per cycle)										
			2.54	*5.01*	*26.71*	*0.00*			*1.03*	*35.29*
Type C	**152,172.00**	**TON**	**387,077**	**761,929**	**4,064,514**	**0**	**0**	**0**	**157,257**	**5,370,777**
			0.79	*1.03*	*26.71*	*0.00*	*0.00*	*0.00*	*0.35*	*28.88*
USR Type C Stone	152,172.00	TON	120,252	156,831	4,064,514	0	0	0	52,918	4,394,514
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)										

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.69*	*6.42*
USR Haul from Sandusky	152,172.00	TON	266,825	605,098	0	0	0	0	104,339	976,262
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.46	*4.90*	*7.63*	*0.00*			*1.00*	*15.99*
Type D	**50,635.00**	**TON**	**124,587**	**248,037**	**386,345**	**0**	**0**	**0**	**50,474**	**809,443**
			0.71	*0.92*	*7.63*	*0.00*	*0.00*	*0.00*	*0.31*	*9.57*
USR Type D Stone	50,635.00	TON	35,802	46,692	386,345	0	0	0	15,755	484,593
(Note: (4" Minus) ODOT 703.19A Crushed Ag clev e brkwtr 30/ton)										
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.69*	*6.42*
USR Haul from Sandusky	50,635.00	TON	88,786	201,345	0	0	0	0	34,719	324,850
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.54	*5.01*	*26.71*	*0.00*			*1.03*	*35.29*
Type E	**47,281.00**	**TON**	**120,268**	**236,737**	**1,262,876**	**0**	**0**	**0**	**48,861**	**1,668,741**
			0.79	*1.03*	*26.71*	*0.00*	*0.00*	*0.00*	*0.35*	*28.88*
USR Type C and E Stone	47,281.00	TON	37,363	48,729	1,262,876	0	0	0	16,442	1,365,409
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)										
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.69*	*6.42*
USR Haul from Sandusky	47,281.00	TON	82,905	188,008	0	0	0	0	32,419	303,332
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.43	*4.85*	*7.63*	*0.00*			*0.98*	*15.89*
Type F	**2,542.00**	**TON**	**6,165**	**12,335**	**19,395**	**0**	**0**	**0**	**2,494**	**40,389**
			0.67	*0.88*	*7.63*	*0.00*	*0.00*	*0.00*	*0.30*	*9.47*
USR Type F Stone	2,542.00	TON	1,707	2,227	19,395	0	0	0	751	24,081
(Note: (3/4" to 1") ODOT 703.01 Size No. 68 clev e brkwtr 20/ton)										
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.69*	*6.42*
USR Haul from Sandusky	2,542.00	TON	4,457	10,108	0	0	0	0	1,743	16,308
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.69	*5.20*	*33.35*	*0.00*			*1.10*	*42.34*
Type H	**83,886.00**	**TON**	**225,712**	**436,104**	**2,797,598**	**0**	**0**	**0**	**92,116**	**3,551,530**
			0.94	*1.22*	*33.35*	*0.00*	*0.00*	*0.00*	*0.41*	*35.92*
USR Type H Stone	83,886.00	TON	78,623	102,539	2,797,598	0	0	0	34,598	3,013,358
(Note: (6" - 18") ODOT 703.19B Type C)										
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.69*	*6.42*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
USR Haul from Sandusky	83,886.00	TON	147,089	333,565	0	0	0	0	57,518	538,172
(Note: 2400 tons per trip, 24 hrs per trip)										
			1,128.95	*1,242.95*	*11,101.96*	*0.00*			*499.49*	*15,014.77*
PZC 13 Combi-wall	**4,500.00**	**LF**	**5,080,289**	**5,593,261**	**49,958,837**	**0**	**4,686,375**	**0**	**2,247,696**	**67,566,457**
(Note:)										
			6.15	*5.12*	*202.42*	*0.00*			*2.74*	*216.43*
C King Pile (Beam)	**105,672.00**	**LF**	**649,995**	**541,027**	**21,390,200**	**0**	**0**	**0**	**289,163**	**22,870,385**
(Note: Includes BBS-M and BBS-F King piles are 66 feet in length. Lengths are on the high end for transportation purposes. From Civil/Structural Design assume that the lengths can be made and delivered without any splicing required at this point in the study.)										
			0.00	*0.00*	*2,165.00*	*0.00*	*0.00*	*0.00*	*0.00*	*2,165.00*
USR Material Price King Pile & connectors	9,880.00	TON	0	0	21,390,200	0	0	0	0	21,390,200
(Note: Connectors welded to pile.)										
			6.15	*5.12*	*0.00*	*0.00*	*0.00*	*0.00*	*2.74*	*14.01*
USR King pile installation	105,672.00	LF	649,995	541,027	0	0	0	0	289,163	1,480,185
(Note: Say 1 pile at 66 ft per hour due to tolerances.)										
			172.75	*143.79*	*2,035.00*	*0.00*			*76.85*	*2,428.40*
C PZC 13	**9,880.00**	**TON**	**1,706,802**	**1,420,666**	**20,105,800**	**0**	**0**	**0**	**759,305**	**23,992,572**
(Note: SSP piles are 125-140 feet in length. Lengths are on the high end for transportation purposes. From Civil/Structural Design assume that the lengths can be made and delivered without any splicing required at this point in the study.)										
			172.75	*143.79*	*0.00*	*0.00*	*0.00*	*0.00*	*76.85*	*393.40*
USR Steel Sheet Pile Installation	9,880.00	TON	1,706,802	1,420,666	0	0	0	0	759,305	3,886,772
(Note: 125 -140 foot sheets approx 2 ft wide @ say 2.0 sheets per hour = 250-280 sf/hr Reduce crew output due to need to thread in SSP at both sides and tight tolerances.)										
			0.00	*0.00*	*2,035.00*	*0.00*	*0.00*	*0.00*	*0.00*	*2,035.00*
USR Material Price SSP	9,880.00	TON	0	0	20,105,800	0	0	0	0	20,105,800
			1,408.84	*1,198.28*	*6,500.00*	*0.00*			*631.22*	*9,738.33*
C Tie Rods	**389.00**	**EA**	**548,039**	**466,129**	**2,528,500**	**0**	**0**	**0**	**245,543**	**3,788,211**
			0.87	*0.74*	*4.00*	*0.00*	*0.00*	*0.00*	*0.39*	*5.99*
USR Wale & Tie Rod installation	632,125.00	LB	548,039	466,129	2,528,500	0	0	0	245,543	3,788,211
(Note: Reviewed the Chicago Shoreline beach job and price quote for wales @ $1.38/lb. Update due to current rates Use $2.00/lb ADJUST PRICE OF TIE RODS (DOUBLE THAT OF WALES).)										
			0.87	*0.74*	*2.00*	*0.00*			*0.39*	*3.99*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
C Wales	**1,179,001.56**	**LB**	**1,022,169**	**869,396**	**2,358,003**	**0**	**0**	**0**	**457,972**	**4,707,541**
			0.87	*0.74*	*2.00*	*0.00*	*0.00*	*0.00*	*0.39*	*3.99*
USR Wale & Tie Rod installation	1,179,001.56	LB	1,022,169	869,396	2,358,003	0	0	0	457,972	4,707,541
(Note: Reviewed the Chicago Shoreline beach job and price quote for wales @ $1.38/lb. Update due to current rates Use $2.00/lb)										
			2.46	*4.90*	*7.63*	*0.00*			*1.06*	*16.05*
Granular Fill	**468,720.00**	**TON**	**1,153,284**	**2,296,042**	**3,576,334**	**0**	**0**	**0**	**495,712**	**7,521,372**
(Note: Use Type D material.)										
			0.71	*0.92*	*7.63*	*0.00*	*0.00*	*0.00*	*0.31*	*9.57*
USR Type D Stone	468,720.00	TON	331,410	432,221	3,576,334	0	0	0	145,839	4,485,803
(Note: (4" Minus) ODOT 703.19A Crushed Ag clev e brkwtr 30/ton)										
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.75*	*6.48*
USR Haul from Sandusky	468,720.00	TON	821,874	1,863,821	0	0	0	0	349,873	3,035,569
(Note: 2400 tons per trip, 24 hrs per trip)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*432.60*
C Concrete Cap	**10,833.04**	**CY**	**0**	**0**	**0**	**0**	**4,686,375**	**0**	**0**	**4,686,375**
			0.00	*0.00*	*0.00*	*0.00*	*412.00*	*0.00*	*0.00*	*412.00*
USR Concrete Cap	11,374.70	CY	0	0	0	0	4,686,375	0	0	4,686,375
(Note: From Chicago Shoreline 40-41 beach estimate approx. $400/cy Updated using ENR June 08 - June 07 = 1.03 = $412/cy (includes reinforcing and formwork). Add 5% to Qty for waste. Leave contractor unassigned as bid abstract price includes OH & Profit.)										
Mitagation	**1.00**	**LS**	**0**	**0**	**0**	**0**	**0**	**250,000**	**0**	**250,000**
USR Mitagation	1.00	LS	0	0	0	0	0	250,000	0	250,000
(Note: Per PM Mitagation costs from Friends of Chicago River project escalated to the scope of this project. Leave contractor unassigned.)										
Cell 2	**1.00**	**LS**	**9,032,483**	**16,614,935**	**99,667,775**	**15,600**	**35,000**	**250,000**	**3,728,362**	**129,344,155**
(Note: Stone breakwater CDF.)										
General Conditions	**1.00**	**LS**	**527,035**	**247,586**	**31,600**	**15,600**	**0**	**0**	**252,138**	**1,073,959**
Temporary Office	**1.00**	**LS**	**16,773**	**0**	**14,400**	**15,600**	**0**	**0**	**8,098**	**54,871**
			0.00	*0.00*	*300.00*	*0.00*	*0.00*	*0.00*	*0.00*	*300.00*
AF 015205000550 Office Trailer, furnished, rent per month, 50' x 12', excl. hookups	36.00	MO	0	0	10,800	0	0	0	0	10,800
			0.00	*0.00*	*0.00*	*400.00*	*0.00*	*0.00*	*0.00*	*400.00*
USR Utility Costs	36.00	MO	0	0	0	14,400	0	0	0	14,400

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
(Note: Include Electric, Phone, Fax and Supplies)										
USR Mob and Demob Office Trailer	1.00	LS	0	0	0	1,200	0	0	0	1,200
			465.92	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*	*224.95*	*790.87*
USR Janitorial	36.00	MO	16,773	0	3,600	0	0	0	8,098	28,471
Submittals	**1.00**	**LS**	**20,003**	**0**	**10,000**	**0**	**0**	**0**	**10,061**	**40,064**
USR Reproduction and Mail	1.00	LS	0	0	10,000	0	0	0	0	10,000
			666.76	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*335.37*	*1,002.13*
USR Initial Project Submittals	30.00	DAY	20,003	0	0	0	0	0	10,061	30,064
Mob and Demob	**1.00**	**LS**	**47,430**	**81,930**	**0**	**0**	**0**	**0**	**20,573**	**149,933**
(Note: Assume 3 days initial mob + 2 days demob year 1 + 2 days mob year 2 + 2 days demob year 2 + year 3 (11 days @ 12 hrs/day))										
			157.81	*357.88*	*0.00*	*0.00*	*0.00*	*0.00*	*67.18*	*582.87*
USR 1 tug + 4 barges + 1 Eng + 1 Oper + 2 Tug Workers	132.00	HR	20,831	47,240	0	0	0	0	8,868	76,938
			201.51	*262.81*	*0.00*	*0.00*	*0.00*	*0.00*	*88.68*	*552.99*
USR 1 Spud Barge + 1 Crane + 1 tug + 2 Oper + 2 Deck	132.00	HR	26,599	34,691	0	0	0	0	11,705	72,995
Quality Control On-Site	**1.00**	**LS**	**442,829**	**165,656**	**7,200**	**0**	**0**	**0**	**213,406**	**829,091**
			12,300.80	*4,601.55*	*200.00*	*0.00*	*0.00*	*0.00*	*5,927.95*	*23,030.30*
USR Quality Control	36.00	MO	442,829	165,656	7,200	0	0	0	213,406	829,091
			3.28	*5.97*	*57.25*	*0.00*			*1.36*	*67.85*
Type A	**446,199.00**	**TON**	**1,463,548**	**2,662,634**	**25,544,893**	**0**	**0**	**0**	**605,695**	**30,276,771**
			1.53	*1.99*	*57.25*	*0.00*	*0.00*	*0.00*	*0.67*	*61.44*
USR Type A Armor Stone (5 ton to 10 ton)	446,199.00	TON	681,163	888,365	25,544,893	0	0	0	299,751	27,414,173
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.69*	*6.42*
USR Haul from Sandusky	446,199.00	TON	782,385	1,774,269	0	0	0	0	305,944	2,862,598
(Note: 2400 tons per cycle, 24 hrs per cycle)										
			2.94	*5.52*	*52.32*	*0.00*			*1.21*	*61.99*
Type B	**479,241.00**	**TON**	**1,408,392**	**2,646,527**	**25,073,889**	**0**	**0**	**0**	**578,583**	**29,707,392**
			1.19	*1.55*	*52.32*	*0.00*	*0.00*	*0.00*	*0.52*	*55.57*
USR Type B Stone (600 lb to 2000 lb) Placed for CDF	479,241.00	TON	568,070	740,870	25,073,889	0	0	0	249,983	26,632,812

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.69*	*6.42*
USR Haul from Sandusky	479,241.00	TON	840,322	1,905,657	0	0	0	0	328,600	3,074,580
(Note: 2400 tons per cycle, 24 hrs per cycle)										
			2.54	*5.01*	*26.71*	*0.00*			*1.03*	*35.29*
Type C	**1,243,648.00**	**TON**	**3,163,442**	**6,226,974**	**33,217,838**	**0**	**0**	**0**	**1,285,206**	**43,893,461**
			0.79	*1.03*	*26.71*	*0.00*	*0.00*	*0.00*	*0.35*	*28.88*
USR Type C Stone	1,243,648.00	TON	982,775	1,281,723	33,217,838	0	0	0	432,477	35,914,813
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)										
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.69*	*6.42*
USR Haul from Sandusky	1,243,648.00	TON	2,180,668	4,945,251	0	0	0	0	852,729	7,978,647
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.46	*4.90*	*7.63*	*0.00*			*1.00*	*15.99*
Type D	**47,522.00**	**TON**	**116,928**	**232,788**	**362,593**	**0**	**0**	**0**	**47,370**	**759,679**
			0.71	*0.92*	*7.63*	*0.00*	*0.00*	*0.00*	*0.31*	*9.57*
USR Type D Stone	47,522.00	TON	33,601	43,821	362,593	0	0	0	14,786	454,801
(Note: (4" Minus) ODOT 703.19A Crushed Ag clev e brkwtr 30/ton)										
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.69*	*6.42*
USR Haul from Sandusky	47,522.00	TON	83,327	188,967	0	0	0	0	32,584	304,878
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.54	*5.01*	*26.71*	*0.00*			*1.03*	*35.29*
Type E	**323,144.00**	**TON**	**821,975**	**1,617,989**	**8,631,176**	**0**	**0**	**0**	**333,942**	**11,405,083**
			0.79	*1.03*	*26.71*	*0.00*	*0.00*	*0.00*	*0.35*	*28.88*
USR Type C and E Stone	323,144.00	TON	255,360	333,037	8,631,176	0	0	0	112,373	9,331,946
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)										
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.69*	*6.42*
USR Haul from Sandusky	323,144.00	TON	566,615	1,284,952	0	0	0	0	221,569	2,073,136
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.43	*4.85*	*7.63*	*0.00*			*0.98*	*15.89*
Type F	**566,840.00**	**TON**	**1,374,669**	**2,750,552**	**4,324,989**	**0**	**0**	**0**	**556,214**	**9,006,424**
			0.67	*0.88*	*7.63*	*0.00*	*0.00*	*0.00*	*0.30*	*9.47*
USR Type F Stone	566,840.00	TON	380,746	496,565	4,324,989	0	0	0	167,550	5,369,851
(Note: (3/4" to 1") ODOT 703.01 Size No. 68 clev e brkwtr 20/ton)										
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.69*	*6.42*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
USR Haul from Sandusky	566,840.00	TON	993,922	2,253,987	0	0	0	0	388,664	3,636,573
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.69	*5.20*	*33.35*	*0.00*			*1.10*	*42.34*
Type H	**7,642.00**	**TON**	**20,562**	**39,729**	**254,861**	**0**	**0**	**0**	**8,392**	**323,544**
			0.94	*1.22*	*33.35*	*0.00*	*0.00*	*0.00*	*0.41*	*35.92*
USR Type H Stone	7,642.00	TON	7,163	9,341	254,861	0	0	0	3,152	274,516
(Note: (6" - 18") ODOT 703.19B Type C)										
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.69*	*6.42*
USR Haul from Sandusky	7,642.00	TON	13,400	30,388	0	0	0	0	5,240	49,027
(Note: 2400 tons per trip, 24 hrs per trip)										
Weir and Walkway	**1.00**	**LS**	**16,531**	**14,710**	**4,037**	**0**	**0**	**0**	**7,217**	**42,495**
(Note: Quantities obtained from Dike 10b IGE dated June 1996)										
			15,072.96	*14,633.01*	*1,420.50*	*0.00*			*6,589.84*	*37,716.31*
Wier	**1.00**	**EA**	**15,073**	**14,633**	**1,421**	**0**	**0**	**0**	**6,590**	**37,716**
			16.75	*16.26*	*0.70*	*0.00*	*0.00*	*0.00*	*7.32*	*41.03*
MIL 031104300150 C.I.P. concrete forms, footing, continuous wall, plywood, 4 use, includes erecting, bracing, stripping and cleaning	300.00	SFC	5,024	4,878	210	0	0	0	2,197	12,309
			2,512.16	*2,438.83*	*541.50*	*0.00*	*0.00*	*0.00*	*1,098.31*	*6,590.80*
MIL 032106000700 Reinforcing steel, in place, walls, #3 to #7, A615, grade 60	1.00	TON	2,512	2,439	542	0	0	0	1,098	6,591
			418.69	*406.47*	*0.00*	*0.00*	*0.00*	*0.00*	*183.05*	*1,008.22*
USR 033107005400 Structural concrete, placing, walls, with crane and bucket, 15" thick, includes vibrating, excludes material	6.00	CY	2,512	2,439	0	0	0	0	1,098	6,049
			0.00	*0.00*	*110.00*	*0.00*	*0.00*	*0.00*	*0.00*	*110.00*
MIL 033102200300 Structural concrete, ready mix, normal weight, 4000 PSI, includes material only	6.00	CY	0	0	660	0	0	0	0	660
			16.75	*16.26*	*0.03*	*0.00*	*0.00*	*0.00*	*7.32*	*40.36*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
MIL 033503500010 Concrete finishing, walls, includes breaking ties and patching voids	300.00	SF	5,024	4,878	9	0	0	0	2,197	12,108
			1,457.77	*77.29*	*2,616.00*	*0.00*			*627.51*	*4,778.57*
Walkway, Railing and Ladder	**1.00**	**EA**	**1,458**	**77**	**2,616**	**0**	**0**	**0**	**628**	**4,779**
			9.02	*0.42*	*19.75*	*0.00*	*0.00*	*0.00*	*3.88*	*33.07*
RSM 055207000020 Railing, pipe, aluminum, satin finish, 2 rails, 1-1/4" dia	20.00	LF	180	8	395	0	0	0	78	661
			2.41	*0.11*	*10.70*	*0.00*	*0.00*	*0.00*	*1.04*	*14.25*
MIL 055303400694 Floor grating, steel, galvanized, 1-1/4" x 3/16" bearing bars @ 15/16" O.C., cross bars @ 4" O.C., 9.1 #/S.F., up to 300 S.F.	100.00	SF	241	11	1,070	0	0	0	104	1,425
			30.18	*1.87*	*6.55*	*0.00*	*0.00*	*0.00*	*13.00*	*51.61*
MIL 051204400672 Channel framing, structural steel, field fabricated, C8x11.5, incl cutting & welding	20.00	LF	604	37	131	0	0	0	260	1,032
			28.87	*1.35*	*68.00*	*0.00*	*0.00*	*0.00*	*12.42*	*110.64*
MIL 055145000020 Ladder, steel, 20" W, bolted to concrete, incl cage	15.00	VLF	433	20	1,020	0	0	0	186	1,660
			91.35	*134.23*	*1,700.00*	*0.00*			*41.01*	*1,966.60*
CZ67	**1,307.00**	**TON**	**119,401**	**175,445**	**2,221,900**	**0**	**0**	**0**	**53,603**	**2,570,348**
			91.35	*134.23*	*1,700.00*	*0.00*	*0.00*	*0.00*	*41.01*	*1,966.60*
USR Marine Sheet piling, steel, 38 psf, 40' excavation, left in place, excludes wales	1,307.00	TON	119,401	175,445	2,221,900	0	0	0	53,603	2,570,348
(Note: Modified for Marine Plant. Sttel Sheet Pile price adjusted from $816.21 ton to more current prices of $1700/ton)										
Fish Removal	**1.00**	**LS**	**0**	**0**	**0**	**0**	**35,000**	**0**	**0**	**35,000**
USR Fish Removal	1.00	LS	0	0	0	0	35,000	0	0	35,000
(Note: From Cleveland 10 B.)										
Mitagation	**1.00**	**LS**	**0**	**0**	**0**	**0**	**0**	**250,000**	**0**	**250,000**
USR Mitagation	1.00	LS	0	0	0	0	0	250,000	0	250,000

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
(Note: Per PM Mitagation costs from Friends of Chicago River project escalated to the scope of this project. Leave contractor unassigned.)										

Description **Page**

Description **Page**

E55 CDF Back to Back Open Cell Plan4

This estimate is from sketches / drawings supplied by Mike Mohr. It is a revision to the 062008 local preferred plan. Due to the amount and lengths of steel LB Foster was contactred for a price quote on the steel. Stone prices are from J. Deans 2006 cost estimate and have been escaulated to acurrent price levels.

March 2009 Added Mitagation measures to each phase.

Estimated by	LRB jw
Designed by	LRB- ftl, mm
Prepared by	James Wryk
Preparation Date	8/29/2008
Effective Date of Pricing	8/29/2008
Estimated Construction Time	Days

Date	Author	Note
6/18/2008	jw	It is anticipated that this CDF loction can be built almost entirly using land plant. Self unloaders hauling smaller core and granular fill may be utilized when possible.
6/24/2008	jw	Design from F. Lewandowski (SSP System) and stone cross section from M. Mohr. SSP system is a combi-wall system constinting of King Piles with SSP in between. King Piles @ approx. 66 feet and the SSP at approx 90 feet in length. It is questionable if the piles and the SSP can be purchased and transported in the lengths indicated. From Civil Structural- anticipate that these lengths can be purchased and transported to the job site either by truck, rail or barge.
		Stone Cross Section is the anticipated overall cross section of each section. The different types, sizes and layer thickness have not been developed as of the date of this estimate 6/24/2008. See next note on development of cost for the stone.
6/24/2008	jw	Stone Cost - Because only an overall cross section was developed at this stage of study for the stone portion (not the different types layer thickness and sizes, Estimating has attempted to develop one unit cost for the cost of stone by using Cleveland 10 B and the Cleveland DMMP Site 2 estimate and prorating the different stone amounts vs. the stone total and using that percentage multiplied by the cost of the stone. Adding up the percentage of the cost ves the total tonnage placed gives one overall cost of stone.
		LOW End Cost - Stone Costs from the Cleveland 10B CDF escalated to current price levels. A contingency cost is added to the stone cost as these costs seem on the low side as compared to current costs that are being received for various jobs due to the size of the job as well as fuel cost.
		High End Cost – Stone costs from Cleveland DMMP study developed in 2006. Price Quotes received for this study. Due to the amount of stone and the uncertinties to the design these cost from the suppliers contain contingencies. After reviewing the costs and how they were developed a composite cost for all stone was developed as described above. This was then inserted into the estimate. Contingencies were not added to the stone costs as was not in the earlier DMMP estimates because stone supply costs already contain contingencies. The rest of the estimate does contain contingencies to cover unknowns.
		Development of the estimate in this manner gives a range of costs that the project could fall between.
6/24/2008	jw	Estimate boken into 3 phases starting from the East and working to the west. Because the phases may be completed by different contracts, Mob/Demob, Wier Structure and fih removal is added to all phases of the estimate.
6/24/2008	jw	After the first estimate was developed a Direct Link method was used for the remaning estimate to speed up the development of the estimate. This however produces some unusual quantities such as a phase of construction with tie rods that are to the tenths of a tie rod. For this stage of study estimating did not go back in to address this issue.
6/24/2008	jw	Most of this cost estimate is taken from previous work such as the Cleveland 10B CDF estimate and the Cleveland DMMP Site #2 estimate. Therefore not a lot of detailed work has been completed. Most of estimate is previous wotk escluated to current price levels and for the stone a single cost developed as described in notes above.
6/24/2008	jw	Estimates DO NOT INCLUDE any dredging that may be required for realignment of the navigation channel that may become necessary due to this alternative.
12/30/2008	jw	This estimate is a modification of the original Back to Back estimate completed in August 2008. The original estimate could not be found and this was recreated from a copy of the combiwall estimate and the paper copy of the estimate in cost engineering files. Items have been reviewed and reestimated to better represent the design.
		Items also have been addressed to answer the Dr. Checks comments.

Description	Quantity	UOM	ContractCost	Contingency	ProjectCost
Project Cost Summary Report			**190,842,871**	**47,585,718**	**238,428,589**
Plan4 Back to Back Cell Design	**1.00**	**LS**	**190,842,871**	**47,585,718**	**238,428,589**
Phase 1	**1.00**	**LS**	**88,526,229**	**22,089,891**	**110,616,120**
			1,121,894.49		*1,402,368.11*
General Conditions	**1.00**	**EA**	**1,121,894**	**280,474**	**1,402,368**
			37,214,094.22		*46,517,617.78*
Stone	**1.00**	**EA**	**37,214,094**	**9,303,524**	**46,517,618**
Wier Structure & Walkway	**1.00**	**LS**	**115,000**	**28,750**	**143,750**
			35,000.00		*43,750.00*
Fish Removal	**1.00**	**EA**	**35,000**	**8,750**	**43,750**
			1,525.54		*1,906.93*
Outfall Relocation	**2,670.00**	**LF**	**4,073,192**	**1,018,298**	**5,091,491**
			6.10		*7.63*
Geotextile	**25,000.00**	**SY**	**152,554**	**38,139**	**190,693**
			15,811.51		*19,764.39*
Open Cell Design	**2,887.00**	**LF**	**45,647,827**	**11,411,957**	**57,059,784**
Mitagation	**1.00**	**LS**	**166,667**	**0**	**166,667**
Phase 2	**1.00**	**LS**	**43,439,360**	**10,818,173**	**54,257,533**
			1,121,894.49		*1,402,368.11*
General Conditions	**1.00**	**EA**	**1,121,894**	**280,474**	**1,402,368**
			1,250.00		*1,562.50*
Outfall Relocation	**1,600.00**	**LF**	**2,000,000**	**500,000**	**2,500,000**
			24,220,740.91		*30,275,926.14*
Stone	**1.00**	**EA**	**24,220,741**	**6,055,185**	**30,275,926**
Wier Structure & Walkway	**1.00**	**LS**	**140,350**	**35,087**	**175,437**
			42,715.13		*53,393.91*
Fish Removal	**1.00**	**EA**	**42,715**	**10,679**	**53,394**
			16,489.00		*20,611.25*
Open Cell Design	**955.00**	**LF**	**15,746,993**	**3,936,748**	**19,683,742**
Mitagation	**1.00**	**LS**	**166,666**	**0**	**166,666**
Phase 3	**1.00**	**LS**	**58,877,283**	**14,677,654**	**73,554,937**

Description	Quantity	UOM	ContractCost	Contingency	ProjectCost
			1,121,894.49		*1,402,368.11*
General Conditions	**1.00**	**EA**	**1,121,894**	**280,474**	**1,402,368**
			20,981,493.10		*26,226,866.38*
Stone	**1.00**	**EA**	**20,981,493**	**5,245,373**	**26,226,866**
Wier Structure & Walkway	**1.00**	**LS**	**140,350**	**35,087**	**175,437**
			42,715.13		*53,393.91*
Fish Removal	**1.00**	**EA**	**42,715**	**10,679**	**53,394**
			15,740.78		*19,675.97*
Open Cell Design	**2,314.00**	**LF**	**36,424,163**	**9,106,041**	**45,530,204**
Mitagation	**1.00**	**LS**	**166,667**	**0**	**166,667**

Description	Quantity	UOM	DirectCost	SubCMU	PrimeCMU	ContractCost
Contract Cost Summary Report			**157,354,844**	**0**	**33,488,028**	**190,842,871**
Plan4 Back to Back Cell Design	**1.00**	**LS**	**157,354,844**	**0**	**33,488,028**	**190,842,871**
Phase 1	**1.00**	**LS**	**73,097,002**	**0**	**15,429,227**	**88,526,229**
General Conditions	**1.00**	**EA**	*919,259.98* **919,260**	**0**	**202,635**	*1,121,894.49* **1,121,894**
Stone	**1.00**	**EA**	*30,492,553.41* **30,492,553**	**0**	**6,721,541**	*37,214,094.22* **37,214,094**
Wier Structure & Walkway	**1.00**	**LS**	**115,000**	**0**	**0**	**115,000**
Fish Removal	**1.00**	**EA**	*35,000.00* **35,000**	**0**	**0**	*35,000.00* **35,000**
Outfall Relocation	**2,670.00**	**LF**	*1,250.00* **3,337,500**	**0**	**735,692**	*1,525.54* **4,073,192**
Geotextile	**25,000.00**	**SY**	*5.00* **125,000**	**0**	**27,554**	*6.10* **152,554**
Open Cell Design	**2,887.00**	**LF**	*13,129.90* **37,906,021**	**0**	**7,741,806**	*15,811.51* **45,647,827**
Mitagation	**1.00**	**LS**	**166,667**	**0**	**0**	**166,667**
Phase 2	**1.00**	**LS**	**35,984,762**	**0**	**7,454,598**	**43,439,360**
General Conditions	**1.00**	**EA**	*919,259.98* **919,260**	**0**	**202,635**	*1,121,894.49* **1,121,894**
Outfall Relocation	**1,600.00**	**LF**	*1,250.00* **2,000,000**	**0**	**0**	*1,250.00* **2,000,000**
Stone	**1.00**	**EA**	*19,846,035.53* **19,846,036**	**0**	**4,374,705**	*24,220,740.91* **24,220,741**
Wier Structure & Walkway	**1.00**	**LS**	**115,000**	**0**	**25,350**	**140,350**
Fish Removal	**1.00**	**EA**	*35,000.00* **35,000**	**0**	**7,715**	*42,715.13* **42,715**
Open Cell Design	**955.00**	**LF**	*13,510.79* **12,902,801**	**0**	**2,844,193**	*16,489.00* **15,746,993**
Mitagation	**1.00**	**LS**	**166,666**	**0**	**0**	**166,666**
Phase 3	**1.00**	**LS**	**48,273,080**	**0**	**10,604,203**	**58,877,283**

Description	Quantity	UOM	DirectCost	SubCMU	PrimeCMU	ContractCost
			919,259.98			*1,121,894.49*
General Conditions	**1.00**	**EA**	**919,260**	**0**	**202,635**	**1,121,894**
			17,191,854.66			*20,981,493.10*
Stone	**1.00**	**EA**	**17,191,855**	**0**	**3,789,638**	**20,981,493**
Wier Structure & Walkway	**1.00**	**LS**	**115,000**	**0**	**25,350**	**140,350**
			35,000.00			*42,715.13*
Fish Removal	**1.00**	**EA**	**35,000**	**0**	**7,715**	**42,715**
			12,897.71			*15,740.78*
Open Cell Design	**2,314.00**	**LF**	**29,845,298**	**0**	**6,578,865**	**36,424,163**
Mitagation	**1.00**	**LS**	**166,667**	**0**	**0**	**166,667**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
Project Direct Costs Report			**12,901,599**	**18,893,627**	**110,821,079**	**46,800**	**11,712,444**	**625,000**	**2,354,294**	**157,354,844**
Plan4 Back to Back Cell Design	**1.00**	**LS**	**12,901,599**	**18,893,627**	**110,821,079**	**46,800**	**11,712,444**	**625,000**	**2,354,294**	**157,354,844**
Phase 1	**1.00**	**LS**	**5,742,326**	**8,555,420**	**51,172,771**	**15,600**	**6,272,494**	**291,667**	**1,046,724**	**73,097,002**
(Note: Eastern section of entire CDF area from the West end of the Marina to the First Energy Outfall. Stone prices from Cleveland DMMP 2006 Estimates from Jim Dean.)										
			525,539.40	*247,586.04*	*31,600.00*	*15,600.00*			*98,934.54*	*919,259.98*
General Conditions	**1.00**	**EA**	**525,539**	**247,586**	**31,600**	**15,600**	**0**	**0**	**98,935**	**919,260**
			16,773.12	*0.00*	*14,400.00*	*15,600.00*			*3,191.63*	*49,964.75*
Temporary Office	**1.00**	**EA**	**16,773**	**0**	**14,400**	**15,600**	**0**	**0**	**3,192**	**49,965**
			0.00	*0.00*	*300.00*	*0.00*	*0.00*	*0.00*	*0.00*	*300.00*
AF 015205000550 Office Trailer, furnished, rent per month, 50' x 12', excl. hookups	36.00	MO	0	0	10,800	0	0	0	0	10,800
			0.00	*0.00*	*0.00*	*400.00*	*0.00*	*0.00*	*0.00*	*400.00*
USR Utility Costs	36.00	MO	0	0	0	14,400	0	0	0	14,400
(Note: Include Electric, Phone, Fax and Supplies)										
USR Mob and Demob Office Trailer	1.00	LS	0	0	0	1,200	0	0	0	1,200
			465.92	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*	*88.66*	*654.58*
USR Janitorial	36.00	MO	16,773	0	3,600	0	0	0	3,192	23,565
Submittals	**1.00**	**LS**	**20,003**	**0**	**10,000**	**0**	**0**	**0**	**3,857**	**33,860**
USR Reproduction and Mail	1.00	LS	0	0	10,000	0	0	0	0	10,000
			666.76	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*128.56*	*795.32*
USR Initial Project Submittals	30.00	DAY	20,003	0	0	0	0	0	3,857	23,860
Mob and Demob	**1.00**	**LS**	**45,935**	**81,930**	**0**	**0**	**0**	**0**	**8,339**	**136,204**
(Note: Assume 3 days initial mob + 2 days demob year 1 + 2 days mob year 2 + 2 days demob year 2 + year 3 (11 days @ 12 hrs/day))										
			144.48	*357.88*	*0.00*	*0.00*	*0.00*	*0.00*	*26.20*	*528.56*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
USR 1 tug + 4 barges + 1 Eng + 1 Oper + 2 Tug Workers	132.00	HR	19,071	47,240	0	0	0	0	3,459	69,770
			203.51	*262.81*	*0.00*	*0.00*	*0.00*	*0.00*	*36.97*	*503.29*
USR 1 Spud Barge + 1 Crane + 1 tug + 2 Oper + 2 Deck	132.00	HR	26,863	34,691	0	0	0	0	4,881	66,434
			442,828.80	*165,655.79*	*7,200.00*	*0.00*			*83,546.66*	*699,231.25*
Quality Control On-Site	**1.00**	**EA**	**442,829**	**165,656**	**7,200**	**0**	**0**	**0**	**83,547**	**699,231**
			12,300.80	*4,601.55*	*200.00*	*0.00*	*0.00*	*0.00*	*2,320.74*	*19,423.09*
USR Quality Control	36.00	MO	442,829	165,656	7,200	0	0	0	83,547	699,231
			2,195,380.67	*4,546,487.40*	*23,352,207.26*	*0.00*			*398,478.07*	*30,492,553.41*
Stone	**1.00**	**EA**	**2,195,381**	**4,546,487**	**23,352,207**	**0**	**0**	**0**	**398,478**	**30,492,553**
			2.81	*5.52*	*52.32*	*0.00*			*0.51*	*61.17*
Type B	**42,545.00**	**TON**	**119,683**	**234,948**	**2,225,954**	**0**	**0**	**0**	**21,726**	**2,602,311**
			1.21	*1.55*	*52.32*	*0.00*	*0.00*	*0.00*	*0.22*	*55.29*
USR Type B Stone (600 lb to 2000 lb) Placed for CDF	42,545.00	TON	51,384	65,771	2,225,954	0	0	0	9,339	2,352,449
			1.61	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*5.87*
USR Haul from Sandusky	42,545.00	TON	68,299	169,176	0	0	0	0	12,387	249,862
(Note: 2400 tons per cycle, 24 hrs per cycle)										
			2.41	*5.01*	*26.71*	*0.00*			*0.44*	*34.57*
Type C	**650,166.00**	**TON**	**1,567,232**	**3,255,396**	**17,365,934**	**0**	**0**	**0**	**284,443**	**22,473,004**
			0.81	*1.03*	*26.71*	*0.00*	*0.00*	*0.00*	*0.15*	*28.69*
USR Type C Stone	650,166.00	TON	523,498	670,071	17,365,934	0	0	0	95,145	18,654,649
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)										
			1.61	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*5.87*
USR Haul from Sandusky	650,166.00	TON	1,043,733	2,585,325	0	0	0	0	189,297	3,818,355
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.30	*4.85*	*7.63*	*0.00*			*0.42*	*15.20*
Type F	**128,300.00**	**TON**	**294,936**	**622,567**	**978,929**	**0**	**0**	**0**	**53,552**	**1,949,984**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			0.69	*0.88*	*7.63*	*0.00*	*0.00*	*0.00*	*0.13*	*9.33*
USR Type F Stone	128,300.00	TON	88,972	112,394	978,929	0	0	0	16,197	1,196,491
(Note: (3/4" to 1") ODOT 703.01 Size No. 68 clev e brkwtr 20/ton)										
			1.61	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*5.87*
USR Haul from Sandusky	128,300.00	TON	205,964	510,173	0	0	0	0	37,355	753,492
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.56	*5.20*	*33.35*	*0.00*			*0.46*	*41.57*
Type H	**83,400.00**	**TON**	**213,530**	**433,577**	**2,781,390**	**0**	**0**	**0**	**38,758**	**3,467,254**
			0.95	*1.22*	*33.35*	*0.00*	*0.00*	*0.00*	*0.17*	*35.70*
USR Type H Stone	83,400.00	TON	79,645	101,945	2,781,390	0	0	0	14,475	2,977,455
(Note: (6" - 18") ODOT 703.19B Type C)										
			1.61	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*5.87*
USR Haul from Sandusky	83,400.00	TON	133,885	331,632	0	0	0	0	24,282	489,799
(Note: 2400 tons per trip, 24 hrs per trip)										
Wier Structure & Walkway	**1.00**	**LS**	**0**	**0**	**0**	**0**	**115,000**	**0**	**0**	**115,000**
USR Wier Structure & Walkway	1.00	LS	0	0	0	0	115,000	0	0	115,000
(Note: Assume this wier to be constructed to handle future expansion of the CDF. From Cleveland 10b adjusted to current price levels. Leave contractor unassigned as bid abstract contains OH & P)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*35,000.00*
Fish Removal	**1.00**	**EA**	**0**	**0**	**0**	**0**	**35,000**	**0**	**0**	**35,000**
USR Fish Removal	1.00	LS	0	0	0	0	35,000	0	0	35,000
(Note: From Cleveland 10 B.)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*1,250.00*
Outfall Relocation	**2,670.00**	**LF**	**0**	**0**	**0**	**0**	**3,337,500**	**0**	**0**	**3,337,500**
(Note: Relocated First Energy Outfall 002 & 003. Outfalls to be relocated through the west arm of the first phase of the CDF. No sizes given. Assume the East 20 th street design from Cleveland 10b CDF.)										
			0.00	*0.00*	*0.00*	*0.00*	*1,250.00*	*0.00*	*0.00*	*1,250.00*
USR Outfall Relocation	2,670.00	LF	0	0	0	0	3,337,500	0	0	3,337,500
(Note: From Cleveland CDF 10B E20th Street outfall -171" x 110" Corr Steel Pipe Arch. Low Bidders unit Cost updated by ENR to current date.)										

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*5.00*
Geotextile	**25,000.00**	**SY**	**0**	**0**	**0**	**0**	**0**	**125,000**	**0**	**125,000**
			0.00	*0.00*	*0.00*	*0.00*	*0.00*	*5.00*	*0.00*	*5.00*
USR Geotextile	25,000.00	SY	0	0	0	0	0	125,000	0	125,000
			1,046.56	*1,302.86*	*9,625.55*	*0.00*			*190.27*	*13,129.90*
Open Cell Design	**2,887.00**	**LF**	**3,021,406**	**3,761,346**	**27,788,964**	**0**	**2,784,994**	**0**	**549,312**	**37,906,021**
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*433.13*
Concrete	**6,430.00**	**CY**	**0**	**0**	**0**	**0**	**2,784,994**	**0**	**0**	**2,784,994**
			0.00	*0.00*	*0.00*	*0.00*	*412.50*	*0.00*	*0.00*	*412.50*
USR Concrete Cap	6,751.50	CY	0	0	0	0	2,784,994	0	0	2,784,994
(Note: From Chicago Shoreline 40-41 beach estimate approx. $400/cy updated using ENR June 08 - June 07 = 1.03 =$412/cy (includes reinforcement and formwork). Add 5% to Qty for waste. Leave contractor unassigned as bid abstract price includes OH&P.)										
			2,072,497.92	*1,762,743.38*	*24,675,924.00*	*0.00*			*377,099.52*	*28,888,264.82*
Steel	**1.00**	**EA**	**2,072,498**	**1,762,743**	**24,675,924**	**0**	**0**	**0**	**377,100**	**28,888,265**
			0.00	*0.00*	*2,298.00*	*0.00*	*0.00*	*0.00*	*0.00*	*2,298.00*
USR Material Price Open Cell	10,738.00	TON	0	0	24,675,924	0	0	0	0	24,675,924
			193.01	*164.16*	*0.00*	*0.00*	*0.00*	*0.00*	*35.12*	*392.28*
USR Steel Sheet Pile Installation	10,738.00	TON	2,072,498	1,762,743	0	0	0	0	377,100	4,212,341
			2.33	*4.90*	*7.63*	*0.00*			*0.42*	*15.28*
Granular Fill	**408,000.00**	**TON**	**948,908**	**1,998,603**	**3,113,040**	**0**	**0**	**0**	**172,212**	**6,232,763**
			0.72	*0.92*	*7.63*	*0.00*	*0.00*	*0.00*	*0.13*	*9.40*
USR Type D Stone	408,000.00	TON	293,932	376,229	3,113,040	0	0	0	53,422	3,836,623
(Note: (4" Minus) ODOT 703.19A Crushed Ag clev e brkwtr 30/ton)										
			1.61	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*5.87*
USR Haul from Sandusky	408,000.00	TON	654,976	1,622,374	0	0	0	0	118,790	2,396,140
(Note: 2400 tons per trip, 24 hrs per trip)										
Mitagation	**1.00**	**LS**	**0**	**0**	**0**	**0**	**0**	**166,667**	**0**	**166,667**
USR Mitagation	1.00	LS	0	0	0	0	0	166,667	0	166,667
(Note: Per PM Mitagation costs from Friends of Chicago River project escalated to the scope of this project. Leave contractor unassigned.)										
Phase 2	**1.00**	**LS**	**2,995,448**	**4,516,608**	**24,644,967**	**15,600**	**3,097,925**	**166,666**	**547,548**	**35,984,762**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
(Note: Eastern section of entire CDF area from the West end of the Marina to the First Energy Outfall. Stone prices from Cleveland DMMP 2006 Estimates from Jim Dean.)										
			525,539.40	*247,586.04*	*31,600.00*	*15,600.00*			*98,934.54*	*919,259.98*
General Conditions	**1.00**	**EA**	**525,539**	**247,586**	**31,600**	**15,600**	**0**	**0**	**98,935**	**919,260**
			16,773.12	*0.00*	*14,400.00*	*15,600.00*			*3,191.63*	*49,964.75*
Temporary Office	**1.00**	**EA**	**16,773**	**0**	**14,400**	**15,600**	**0**	**0**	**3,192**	**49,965**
			0.00	*0.00*	*300.00*	*0.00*	*0.00*	*0.00*	*0.00*	*300.00*
AF 015205000550 Office Trailer, furnished, rent per month, 50' x 12', excl. hookups	36.00	MO	0	0	10,800	0	0	0	0	10,800
			0.00	*0.00*	*0.00*	*400.00*	*0.00*	*0.00*	*0.00*	*400.00*
USR Utility Costs	36.00	MO	0	0	0	14,400	0	0	0	14,400
(Note: Include Electric, Phone, Fax and Supplies)										
USR Mob and Demob Office Trailer	1.00	LS	0	0	0	1,200	0	0	0	1,200
			465.92	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*	*88.66*	*654.58*
USR Janitorial	36.00	MO	16,773	0	3,600	0	0	0	3,192	23,565
Submittals	**1.00**	**LS**	**20,003**	**0**	**10,000**	**0**	**0**	**0**	**3,857**	**33,860**
USR Reproduction and Mail	1.00	LS	0	0	10,000	0	0	0	0	10,000
			666.76	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*128.56*	*795.32*
USR Initial Project Submittals	30.00	DAY	20,003	0	0	0	0	0	3,857	23,860
Mob and Demob	**1.00**	**LS**	**45,935**	**81,930**	**0**	**0**	**0**	**0**	**8,339**	**136,204**
(Note: Assume 3 days initial mob + 2 days demob year 1 + 2 days mob year 2 + 2 days demob year 2 + year 3 (11 days @ 12 hrs/day))										
			144.48	*357.88*	*0.00*	*0.00*	*0.00*	*0.00*	*26.20*	*528.56*
USR 1 tug + 4 barges + 1 Eng + 1 Oper + 2 Tug Workers	132.00	HR	19,071	47,240	0	0	0	0	3,459	69,770
			203.51	*262.81*	*0.00*	*0.00*	*0.00*	*0.00*	*36.97*	*503.29*
USR 1 Spud Barge + 1 Crane + 1 tug + 2 Oper + 2 Deck	132.00	HR	26,863	34,691	0	0	0	0	4,881	66,434
			442,828.80	*165,655.79*	*7,200.00*	*0.00*			*83,546.66*	*699,231.25*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
Quality Control On-Site	**1.00**	**EA**	**442,829**	**165,656**	**7,200**	**0**	**0**	**0**	**83,547**	**699,231**
			12,300.80	*4,601.55*	*200.00*	*0.00*	*0.00*	*0.00*	*2,320.74*	*19,423.09*
USR Quality Control	36.00	MO	442,829	165,656	7,200	0	0	0	83,547	699,231
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*1,250.00*
Outfall Relocation	**1,600.00**	**LF**	**0**	**0**	**0**	**0**	**2,000,000**	**0**	**0**	**2,000,000**
(Note: Relocated First Energy Outfall 203. Outfall to be relocated through the west arm of the first phase of the CDF. No sizes given. Assume the East 20 th street design from Cleveland 10b CDF.)										
			0.00	*0.00*	*0.00*	*0.00*	*1,250.00*	*0.00*	*0.00*	*1,250.00*
USR Outfall Relocation	1,600.00	LF	0	0	0	0	2,000,000	0	0	2,000,000
(Note: From Cleveland CDF 10B E20th Street outfall -171" x 110" Corr Steel Pipe Arch. Low Bidders unit Cost updated by ENR to current date.)										
			1,441,424.68	*2,988,612.28*	*15,154,370.00*	*0.00*			*261,628.57*	*19,846,035.53*
Stone	**1.00**	**EA**	**1,441,425**	**2,988,612**	**15,154,370**	**0**	**0**	**0**	**261,629**	**19,846,036**
			2.81	*5.52*	*52.32*	*0.00*			*0.51*	*61.17*
Type B	**26,650.00**	**TON**	**74,969**	**147,170**	**1,394,328**	**0**	**0**	**0**	**13,609**	**1,630,076**
			1.21	*1.55*	*52.32*	*0.00*	*0.00*	*0.00*	*0.22*	*55.29*
USR Type B Stone (600 lb to 2000 lb) Placed for CDF	26,650.00	TON	32,187	41,199	1,394,328	0	0	0	5,850	1,473,564
			1.61	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*5.87*
USR Haul from Sandusky	26,650.00	TON	42,782	105,971	0	0	0	0	7,759	156,513
(Note: 2400 tons per cycle, 24 hrs per cycle)										
			2.41	*5.01*	*26.71*	*0.00*			*0.44*	*34.57*
Type C	**453,600.00**	**TON**	**1,093,407**	**2,271,186**	**12,115,656**	**0**	**0**	**0**	**198,447**	**15,678,695**
			0.81	*1.03*	*26.71*	*0.00*	*0.00*	*0.00*	*0.15*	*28.69*
USR Type C Stone	453,600.00	TON	365,228	467,487	12,115,656	0	0	0	66,380	13,014,751
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)										
			1.61	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*5.87*
USR Haul from Sandusky	453,600.00	TON	728,179	1,803,698	0	0	0	0	132,067	2,663,944
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.30	*4.85*	*7.63*	*0.00*			*0.42*	*15.20*
Type F	**85,700.00**	**TON**	**197,007**	**415,853**	**653,891**	**0**	**0**	**0**	**35,771**	**1,302,522**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			0.69	*0.88*	*7.63*	*0.00*	*0.00*	*0.00*	*0.13*	*9.33*
USR Type F Stone	85,700.00	TON	59,430	75,075	653,891	0	0	0	10,819	799,215
(Note: (3/4" to 1") ODOT 703.01 Size No. 68 clev e brkwtr 20/ton)										
			1.61	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*5.87*
USR Haul from Sandusky	85,700.00	TON	137,577	340,778	0	0	0	0	24,952	503,307
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.56	*5.20*	*33.35*	*0.00*			*0.46*	*41.57*
Type H	**29,700.00**	**TON**	**76,041**	**154,403**	**990,495**	**0**	**0**	**0**	**13,802**	**1,234,742**
			0.95	*1.22*	*33.35*	*0.00*	*0.00*	*0.00*	*0.17*	*35.70*
USR Type H Stone	29,700.00	TON	28,363	36,304	990,495	0	0	0	5,155	1,060,317
(Note: (6" - 18") ODOT 703.19B Type C)										
			1.61	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*5.87*
USR Haul from Sandusky	29,700.00	TON	47,678	118,099	0	0	0	0	8,647	174,425
(Note: 2400 tons per trip, 24 hrs per trip)										
Wier Structure & Walkway	**1.00**	**LS**	**0**	**0**	**0**	**0**	**115,000**	**0**	**0**	**115,000**
USR Wier Structure & Walkway	1.00	LS	0	0	0	0	115,000	0	0	115,000
(Note: Assume this wier to be constructed to handle future expansion of the CDF. From Cleveland 10b adjusted to current price levels. Leave contractor unassigned as bid abstract contains OH & P)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*35,000.00*
Fish Removal	**1.00**	**EA**	**0**	**0**	**0**	**0**	**35,000**	**0**	**0**	**35,000**
USR Fish Removal	1.00	LS	0	0	0	0	35,000	0	0	35,000
(Note: From Cleveland 10 B.)										
			1,076.95	*1,340.74*	*9,904.71*	*0.00*			*195.80*	*13,510.79*
Open Cell Design	**955.00**	**LF**	**1,028,484**	**1,280,409**	**9,458,997**	**0**	**947,925**	**0**	**186,985**	**12,902,801**
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*433.04*
Concrete	**2,189.00**	**CY**	**0**	**0**	**0**	**0**	**947,925**	**0**	**0**	**947,925**
			0.00	*0.00*	*0.00*	*0.00*	*412.50*	*0.00*	*0.00*	*412.50*
USR Concrete Cap	2,298.00	CY	0	0	0	0	947,925	0	0	947,925
(Note: From Chicago Shoreline 40-41 beach estimate approx. $400/cy updated using ENR June 08 - June 07 = 1.03 =$412/cy (includes reinforcement and formwork). Add 5% to Qty for waste. Leave contractor unassigned as bid abstract price includes OH&P.)										

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			193.01	*164.16*	*2,298.00*	*0.00*			*35.12*	*2,690.28*
Steel	**3,655.00**	**TON**	**705,437**	**600,003**	**8,399,190**	**0**	**0**	**0**	**128,357**	**9,832,986**
			0.00	*0.00*	*2,298.00*	*0.00*	*0.00*	*0.00*	*0.00*	*2,298.00*
USR Material Price Open Cell	3,655.00	TON	0	0	8,399,190	0	0	0	0	8,399,190
			193.01	*164.16*	*0.00*	*0.00*	*0.00*	*0.00*	*35.12*	*392.28*
USR Steel Sheet Pile Installation	3,655.00	TON	705,437	600,003	0	0	0	0	128,357	1,433,796
			2.33	*4.90*	*7.63*	*0.00*			*0.42*	*15.28*
Granular Fill	**138,900.00**	**TON**	**323,047**	**680,407**	**1,059,807**	**0**	**0**	**0**	**58,628**	**2,121,889**
			0.72	*0.92*	*7.63*	*0.00*	*0.00*	*0.00*	*0.13*	*9.40*
USR Type D Stone	138,900.00	TON	100,066	128,084	1,059,807	0	0	0	18,187	1,306,144
(Note: (4" Minus) ODOT 703.19A Crushed Ag clev e brkwtr 30/ton)										
			1.61	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*5.87*
USR Haul from Sandusky	138,900.00	TON	222,981	552,323	0	0	0	0	40,441	815,745
(Note: 2400 tons per trip, 24 hrs per trip)										
Mitagation	**1.00**	**LS**	**0**	**0**	**0**	**0**	**0**	**166,666**	**0**	**166,666**
USR Mitagation	1.00	LS	0	0	0	0	0	166,666	0	166,666
(Note: Per PM Mitagation costs from Friends of Chicago River project escalated to the scope of this project. Leave contractor unassigned.)										
Phase 3	**1.00**	**LS**	**4,163,826**	**5,821,600**	**35,003,340**	**15,600**	**2,342,025**	**166,667**	**760,022**	**48,273,080**
(Note: Eastern section of entire CDF area from the West end of the Marina to the First Energy Outfall. Stone prices from Cleveland DMMP 2006 Estimates from Jim Dean.)										
			525,539.40	*247,586.04*	*31,600.00*	*15,600.00*			*98,934.54*	*919,259.98*
General Conditions	**1.00**	**EA**	**525,539**	**247,586**	**31,600**	**15,600**	**0**	**0**	**98,935**	**919,260**
			16,773.12	*0.00*	*14,400.00*	*15,600.00*			*3,191.63*	*49,964.75*
Temporary Office	**1.00**	**EA**	**16,773**	**0**	**14,400**	**15,600**	**0**	**0**	**3,192**	**49,965**
			0.00	*0.00*	*300.00*	*0.00*	*0.00*	*0.00*	*0.00*	*300.00*
AF 015205000550 Office Trailer, furnished, rent per month, 50' x 12', excl. hookups	36.00	MO	0	0	10,800	0	0	0	0	10,800
			0.00	*0.00*	*0.00*	*400.00*	*0.00*	*0.00*	*0.00*	*400.00*
USR Utility Costs	36.00	MO	0	0	0	14,400	0	0	0	14,400

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
(Note: Include Electric, Phone, Fax and Supplies)										
USR Mob and Demob Office Trailer	1.00	LS	0	0	0	1,200	0	0	0	1,200
			465.92	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*	*88.66*	*654.58*
USR Janitorial	36.00	MO	16,773	0	3,600	0	0	0	3,192	23,565
Submittals	**1.00**	**LS**	**20,003**	**0**	**10,000**	**0**	**0**	**0**	**3,857**	**33,860**
USR Reproduction and Mail	1.00	LS	0	0	10,000	0	0	0	0	10,000
			666.76	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*128.56*	*795.32*
USR Initial Project Submittals	30.00	DAY	20,003	0	0	0	0	0	3,857	23,860
Mob and Demob	**1.00**	**LS**	**45,935**	**81,930**	**0**	**0**	**0**	**0**	**8,339**	**136,204**
(Note: Assume 3 days initial mob + 2 days demob year 1 + 2 days mob year 2 + 2 days demob year 2 + year 3 (11 days @ 12 hrs/day))										
			144.48	*357.88*	*0.00*	*0.00*	*0.00*	*0.00*	*26.20*	*528.56*
USR 1 tug + 4 barges + 1 Eng + 1 Oper + 2 Tug Workers	132.00	HR	19,071	47,240	0	0	0	0	3,459	69,770
			203.51	*262.81*	*0.00*	*0.00*	*0.00*	*0.00*	*36.97*	*503.29*
USR 1 Spud Barge + 1 Crane + 1 tug + 2 Oper + 2 Deck	132.00	HR	26,863	34,691	0	0	0	0	4,881	66,434
			442,828.80	*165,655.79*	*7,200.00*	*0.00*			*83,546.66*	*699,231.25*
Quality Control On-Site	**1.00**	**EA**	**442,829**	**165,656**	**7,200**	**0**	**0**	**0**	**83,547**	**699,231**
			12,300.80	*4,601.55*	*200.00*	*0.00*	*0.00*	*0.00*	*2,320.74*	*19,423.09*
USR Quality Control	36.00	MO	442,829	165,656	7,200	0	0	0	83,547	699,231
			1,259,365.30	*2,612,587.36*	*13,091,318.00*	*0.00*			*228,584.00*	*17,191,854.66*
Stone	**1.00**	**EA**	**1,259,365**	**2,612,587**	**13,091,318**	**0**	**0**	**0**	**228,584**	**17,191,855**
			2.81	*5.52*	*52.32*	*0.00*			*0.51*	*61.17*
Type B	**20,600.00**	**TON**	**57,950**	**113,760**	**1,077,792**	**0**	**0**	**0**	**10,520**	**1,260,021**
			1.21	*1.55*	*52.32*	*0.00*	*0.00*	*0.00*	*0.22*	*55.29*
USR Type B Stone (600 lb to 2000 lb) Placed for CDF	20,600.00	TON	24,880	31,846	1,077,792	0	0	0	4,522	1,139,040
			1.61	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*5.87*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
USR Haul from Sandusky	20,600.00	TON	33,070	81,914	0	0	0	0	5,998	120,982
(Note: 2400 tons per cycle, 24 hrs per cycle)										
			2.41	*5.01*	*26.71*	*0.00*			*0.44*	*34.57*
Type C	**397,100.00**	**TON**	**957,213**	**1,988,289**	**10,606,541**	**0**	**0**	**0**	**173,728**	**13,725,771**
			0.81	*1.03*	*26.71*	*0.00*	*0.00*	*0.00*	*0.15*	*28.69*
USR Type C Stone	397,100.00	TON	319,736	409,258	10,606,541	0	0	0	58,112	11,393,646
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)										
			1.61	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*5.87*
USR Haul from Sandusky	397,100.00	TON	637,478	1,579,031	0	0	0	0	115,617	2,332,126
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.30	*4.85*	*7.63*	*0.00*			*0.42*	*15.20*
Type F	**79,500.00**	**TON**	**182,755**	**385,768**	**606,585**	**0**	**0**	**0**	**33,183**	**1,208,291**
			0.69	*0.88*	*7.63*	*0.00*	*0.00*	*0.00*	*0.13*	*9.33*
USR Type F Stone	79,500.00	TON	55,131	69,644	606,585	0	0	0	10,036	741,396
(Note: (3/4" to 1") ODOT 703.01 Size No. 68 clev e brkwtr 20/ton)										
			1.61	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*5.87*
USR Haul from Sandusky	79,500.00	TON	127,624	316,124	0	0	0	0	23,147	466,895
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.56	*5.20*	*33.35*	*0.00*			*0.46*	*41.57*
Type H	**24,000.00**	**TON**	**61,447**	**124,770**	**800,400**	**0**	**0**	**0**	**11,153**	**997,771**
			0.95	*1.22*	*33.35*	*0.00*	*0.00*	*0.00*	*0.17*	*35.70*
USR Type H Stone	24,000.00	TON	22,919	29,337	800,400	0	0	0	4,166	856,822
(Note: (6" - 18") ODOT 703.19B Type C)										
			1.61	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*5.87*
USR Haul from Sandusky	24,000.00	TON	38,528	95,434	0	0	0	0	6,988	140,949
(Note: 2400 tons per trip, 24 hrs per trip)										
Wier Structure & Walkway	**1.00**	**LS**	**0**	**0**	**0**	**0**	**115,000**	**0**	**0**	**115,000**
USR Wier Structure & Walkway	1.00	LS	0	0	0	0	115,000	0	0	115,000

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
(Note: Assume this wier to be constructed to handle future expansion of the CDF. From Cleveland 10b adjusted to current price levels. Leave contractor unassigned as bid abstract contains OH & P)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*35,000.00*
Fish Removal	**1.00**	**EA**	**0**	**0**	**0**	**0**	**35,000**	**0**	**0**	**35,000**
USR Fish Removal	1.00	LS	0	0	0	0	35,000	0	0	35,000
(Note: From Cleveland 10 B.)										
			1,028.06	*1,279.79*	*9,455.67*	*0.00*			*186.91*	*12,897.71*
Open Cell Design	**2,314.00**	**LF**	**2,378,921**	**2,961,427**	**21,880,422**	**0**	**2,192,025**	**0**	**432,504**	**29,845,298**
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*433.12*
Concrete	**5,061.00**	**CY**	**0**	**0**	**0**	**0**	**2,192,025**	**0**	**0**	**2,192,025**
			0.00	*0.00*	*0.00*	*0.00*	*412.50*	*0.00*	*0.00*	*412.50*
USR Concrete Cap	5,314.00	CY	0	0	0	0	2,192,025	0	0	2,192,025
(Note: From Chicago Shoreline 40-41 beach estimate approx. $400/cy updated using ENR June 08 - June 07 = 1.03 =$412/cy (includes reinforcement and formwork). Add 5% to Qty for waste. Leave contractor unassigned as bid abstract price includes OH&P.)										
			193.01	*164.16*	*2,298.00*	*0.00*			*35.12*	*2,690.28*
Steel	**8,455.00**	**TON**	**1,631,865**	**1,387,968**	**19,429,590**	**0**	**0**	**0**	**296,925**	**22,746,347**
			0.00	*0.00*	*2,298.00*	*0.00*	*0.00*	*0.00*	*0.00*	*2,298.00*
USR Material Price Open Cell	8,455.00	TON	0	0	19,429,590	0	0	0	0	19,429,590
			193.01	*164.16*	*0.00*	*0.00*	*0.00*	*0.00*	*35.12*	*392.28*
USR Steel Sheet Pile Installation	8,455.00	TON	1,631,865	1,387,968	0	0	0	0	296,925	3,316,757
			2.33	*4.90*	*7.63*	*0.00*			*0.42*	*15.28*
Granular Fill	**321,210.00**	**TON**	**747,056**	**1,573,459**	**2,450,832**	**0**	**0**	**0**	**135,579**	**4,906,926**
			0.72	*0.92*	*7.63*	*0.00*	*0.00*	*0.00*	*0.13*	*9.40*
USR Type D Stone	321,210.00	TON	231,406	296,197	2,450,832	0	0	0	42,058	3,020,494
(Note: (4" Minus) ODOT 703.19A Crushed Ag clev e brkwtr 30/ton)										
			1.61	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*5.87*
USR Haul from Sandusky	321,210.00	TON	515,649	1,277,262	0	0	0	0	93,521	1,886,432
(Note: 2400 tons per trip, 24 hrs per trip)										
Mitagation	**1.00**	**LS**	**0**	**0**	**0**	**0**	**0**	**166,667**	**0**	**166,667**
USR Mitagation	1.00	LS	0	0	0	0	0	166,667	0	166,667
(Note: Per PM Mitagation costs from Friends of Chicago River project escalated to the scope of this project. Leave contractor unassigned.)										

U.S. Army Corps of Engineers
Project Plan4: E55 CDF Back to Back Open Cell Plan4
COE Standard Report Selections

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Description **Page**

E55 CDF local prefered alternative(Plan4a)REVISED March 2009

This estimate is from sketches / drawings supplied by Mike Mohr. It is a revision to the 062008 local preferred plan. Due to the amount and lengths of steel LB Foster was contacted for a price quote on the steel. Stone prices are from J. Deans 2006 cost estimate and have been escalated to current price levels.

Estimated by	LRB jw
Designed by	LRB- ftl, mm
Prepared by	James Wryk
Preparation Date	8/19/2008
Effective Date of Pricing	8/19/2008
Estimated Construction Time	Days

Date	Author	Note
6/18/2008	jw	It is anticipated that this CDF loction will be built using marine equipment due to the size of the structure. (Due not want equipment on wall if a storm comes up). Self unloaders hauling smaller core and granular fill may be utilized when possible. Larger stone will be hauled from Sandusky OH.
6/24/2008	jw	Design from F. Lewandowski (SSP System) and stone cross section from M. Mohr. SSP system is a combi-wall system constinting of King Piles with SSP in between. King Piles @ approx. 66 feet and the SSP at approx 125 feet in lengthon the lake side and 140 feet on the CDF side. It is questionable if the piles and the SSP can be purchased and transported in the lengths indicated. From Civil Structural- anticipate that these lengths can be purchased and transported to the job site either by truck, rail or barge for this stae of study.
6/24/2008	jw	Stone costs from Cleveland DMMP study developed in 2006. Price Quotes received for this study.
6/24/2008	jw	Estimate broken into 3 phases starting from the East and working to the west. Because the phases may be completed by different contracts, Mob/Demob, Wier Structure and fish removal is added to all phases of the estimate.
6/24/2008	jw	Most of this cost estimate is taken from previous work such as the Cleveland 10B CDF estimate and the Cleveland DMMP Site #2 estimate. Therefore not a lot of detailed work has been completed. Most of estimate is previous wotk escalated to current price levels and for the stone a single cost developed as described in notes above.
6/24/2008	jw	Estimates DO NOT INCLUDE any dredging that may be required for realignment of the navigation channel that may become necessary due to this alternative.
9/8/2008	jw	Revised estimate include new labor rates and esculated stone price quotes to current (4th Qtr FY08) dollars. Estimate NOT escaluated to Future $$.
9/9/2008	jw	15% contingency has been added to this estimate. In addition the price quote from the quarry is on the conservative side not only because of the opening of a new section of quarry but for the uncertainties in the design at the time of the price quote.
12/29/2008	jw	Contingencies updated based on Cost Risk Analysis worked up by Walla Walla District. Equipment Rates updated to latest database Labor Rates updated to latest labor rates

Description	Quantity	UOM	ContractCost	Contingency	ProjectCost
Project Cost Summary Report			**227,241,455**	**50,245,906**	**277,487,361**
Phase 1	**1.00**	**LS**	**106,312,188**	**23,521,847**	**129,834,035**
General Conditions	**1.00**	**EA**	*995,767.57* **995,768**	**220,662**	*1,216,429.67* **1,216,430**
Temporary Office	**1.00**	**EA**	*57,378.45* **57,378**	**12,715**	*70,093.51* **70,094**
Submittals	**1.00**	**LS**	**39,178**	**8,682**	**47,859**
Mob and Demob	**1.00**	**LS**	**168,327**	**37,301**	**205,628**
Quality Control On-Site	**1.00**	**EA**	*730,884.75* **730,885**	**161,964**	*892,848.81* **892,849**
PZC 13 Combi-wall	**2,887.00**	**LF**	*20,719.22* **59,816,384**	**13,255,311**	*25,310.60* **73,071,695**
C King Pile (Beam)	**69,384.00**	**LF**	*325.64* **22,594,070**	**5,006,846**	*397.80* **27,600,916**
C PZC 13	**6,304.00**	**TON**	*2,909.45* **18,341,200**	**4,064,410**	*3,554.19* **22,405,610**
C Tie Rods	**236.00**	**EA**	*11,427.32* **2,696,848**	**597,621**	*13,959.62* **3,294,469**
C Wales	**756,395.00**	**LB**	*4.59* **3,472,885**	**769,591**	*5.61* **4,242,477**
C Concrete Cap	**6,950.00**	**CY**	*432.60* **3,006,570**	**666,256**	*528.46* **3,672,826**
Granular Fill	**515,000.00**	**TON**	*18.84* **9,704,811**	**2,150,586**	*23.02* **11,855,397**
Stone	**1.00**	**LS**	**34,668,296**	**7,682,494**	**42,350,790**
Type B	**42,545.00**	**TON**	*74.86* **3,184,839**	**705,760**	*91.45* **3,890,599**
Type C	**650,166.00**	**TON**	*42.39* **27,562,972**	**6,107,955**	*51.79* **33,670,926**
Type F	**128,300.00**	**TON**	*18.76* **2,406,737**	**533,333**	*22.92* **2,940,070**
Type H	**29,712.00**	**TON**	*50.95* **1,513,748**	**335,447**	*62.24* **1,849,195**

Description	Quantity	UOM	ContractCost	Contingency	ProjectCost
Weir and Walkway	1.00	EA	*45,077.32* 45,077	9,989	*55,066.46* 55,066
Wier	1.00	EA	*40,756.60* 40,757	9,032	*49,788.26* 49,788
Walkway, Railing and Ladder	1.00	EA	*4,320.73* 4,321	957	*5,278.20* 5,278
Fish Removal	1.00	EA	*35,000.00* 35,000	7,756	*42,756.00* 42,756
Outfall Relocation	2,670.00	LF	*1,250.00* 3,337,500	739,590	*1,527.00* 4,077,090
Precast Igloo Units	837.00	EA	*8,476.63* 7,094,943	1,572,239	*10,355.06* 8,667,183
Precast	837.00	EA	*8,183.56* 6,849,637	1,517,880	*9,997.03* 8,367,517
Setting in place	837.00	EA	*293.08* 245,306	54,360	*358.02* 299,666
Geotextile	25,000.00	SY	*6.10* 152,552	33,806	*7.45* 186,358
Mitagation	1.00	EA	*166,667.00* 166,667	0	*166,667.00* 166,667
Phase 2	1.00	LS	49,702,434	10,977,126	60,679,560
General Conditions	1.00	EA	*996,159.93* 996,160	220,749	*1,216,908.97* 1,216,909
Temporary Office	1.00	EA	*57,378.45* 57,378	12,715	*70,093.51* 70,094
Submittals	1.00	LS	39,178	8,682	47,859
Mob and Demob	1.00	LS	168,719	37,388	206,107
Quality Control On-Site	1.00	EA	*730,884.75* 730,885	161,964	*892,848.81* 892,849
Outfall Relocation	1,600.00	LF	*1,250.00* 2,000,000	443,200	*1,527.00* 2,443,200
Stone	1.00	LS	24,304,300	5,385,833	29,690,133

Description	Quantity	UOM	ContractCost	Contingency	ProjectCost
Type B	26,650.00	TON	*74.79* 1,993,125	441,676	*91.36* 2,434,801
Type C	453,600.00	TON	*42.32* 19,198,408	4,254,367	*51.70* 23,452,775
Type F	85,700.00	TON	*18.69* 1,601,687	354,934	*22.83* 1,956,620
Type H	29,700.00	TON	*50.88* 1,511,081	334,856	*62.15* 1,845,937
Weir and Walkway	1.00	EA	*45,077.32* 45,077	9,989	*55,066.46* 55,066
Wier	1.00	EA	*40,756.60* 40,757	9,032	*49,788.26* 49,788
Walkway, Railing and Ladder	1.00	EA	*4,320.73* 4,321	957	*5,278.20* 5,278
Fish Removal	1.00	EA	*35,000.00* 35,000	7,756	*42,756.00* 42,756
Precast Igloo Units	288.00	EA	*8,476.63* 2,441,271	540,986	*10,355.06* 2,982,257
Precast	288.00	EA	*8,183.56* 2,356,864	522,281	*9,997.03* 2,879,146
Setting in place	288.00	EA	*293.08* 84,406	18,704	*358.02* 103,111
PZC 13 Combi-wall	955.00	LF	*20,547.05* 19,622,428	4,348,330	*25,100.27* 23,970,758
C King Pile (Beam)	22,951.76	LF	*325.64* 7,473,965	1,656,231	*397.80* 9,130,195
C PZC 13	2,085.32	TON	*2,909.45* 6,067,144	1,344,479	*3,554.19* 7,411,624
C Tie Rods	78.07	EA	*11,427.32* 892,099	197,689	*13,959.62* 1,089,788
C Wales	250,210.33	LB	*4.59* 1,148,807	254,576	*5.61* 1,403,383
C Concrete Cap	2,299.01	CY	*527.95* 1,213,769	268,971	*644.95* 1,482,740

Description	Quantity	UOM	ContractCost	Contingency	ProjectCost
Granular Fill	**150,000.00**	**TON**	*18.84* **2,826,644**	**626,384**	*23.02* **3,453,028**
Geotextile	**150,000.00**	**SY**	*0.61* **91,531**	**20,283**	*0.75* **111,815**
Mitagation	**1.00**	**EA**	*166,666.00* **166,666**	**0**	*166,666.00* **166,666**
Phase 3	**1.00**	**LS**	**71,226,834**	**15,746,933**	**86,973,766**
General Conditions	**1.00**	**EA**	*996,159.93* **996,160**	**220,749**	*1,216,908.97* **1,216,909**
Temporary Office	**1.00**	**EA**	*57,378.45* **57,378**	**12,715**	*70,093.51* **70,094**
Submittals	**1.00**	**LS**	**39,178**	**8,682**	**47,859**
Mob and Demob	**1.00**	**LS**	**168,719**	**37,388**	**206,107**
Quality Control On-Site	**1.00**	**EA**	*730,884.75* **730,885**	**161,964**	*892,848.81* **892,849**
Stone	**1.00**	**EA**	*21,054,611.14* **21,054,611**	**4,665,702**	*25,720,312.97* **25,720,313**
Type B	**20,600.00**	**TON**	*74.79* **1,540,652**	**341,408**	*91.36* **1,882,060**
Type C	**397,100.00**	**TON**	*42.32* **16,807,072**	**3,724,447**	*51.70* **20,531,519**
Type F	**79,500.00**	**TON**	*18.69* **1,485,812**	**329,256**	*22.83* **1,815,068**
Type H	**24,000.00**	**TON**	*50.88* **1,221,076**	**270,590**	*62.15* **1,491,666**
Fish Removal	**1.00**	**EA**	*35,000.00* **35,000**	**7,756**	*42,756.00* **42,756**
Weir and Walkway	**1.00**	**EA**	*45,077.32* **45,077**	**9,989**	*55,066.46* **55,066**
Wier	**1.00**	**EA**	*40,756.60* **40,757**	**9,032**	*49,788.26* **49,788**
Walkway, Railing and Ladder	**1.00**	**EA**	*4,320.73* **4,321**	**957**	*5,278.20* **5,278**

Description	Quantity	UOM	ContractCost	Contingency	ProjectCost
			8,476.63		*10,355.06*
Precast Igloo Units	**336.00**	**EA**	**2,848,149**	**631,150**	**3,479,299**
			8,183.56		*9,997.03*
Precast	**336.00**	**EA**	**2,749,675**	**609,328**	**3,359,003**
			293.08		*358.02*
Setting in place	**336.00**	**EA**	**98,474**	**21,822**	**120,296**
			19,518.52		*23,843.82*
PZC 13 Combi-wall	**2,314.00**	**LF**	**45,165,856**	**10,008,754**	**55,174,610**
			325.64		*397.80*
C King Pile (Beam)	**51,786.00**	**LF**	**16,863,492**	**3,736,950**	**20,600,441**
			2,893.03		*3,534.13*
C PZC 13	**5,052.81**	**TON**	**14,617,943**	**3,239,336**	**17,857,280**
			11,427.32		*13,959.62*
C Tie Rods	**189.16**	**EA**	**2,161,589**	**479,008**	**2,640,597**
			4.59		*5.61*
C Wales	**607,054.00**	**LB**	**2,787,206**	**617,645**	**3,404,851**
			527.95		*644.95*
C Concrete Cap	**5,570.59**	**CY**	**2,941,006**	**651,727**	**3,592,733**
			18.84		*23.02*
Granular Fill	**307,500.00**	**TON**	**5,794,620**	**1,284,088**	**7,078,708**
			61.02		*74.54*
Geotextile	**15,000.00**	**SY**	**915,312**	**202,833**	**1,118,146**
			166,667.00		*166,667.00*
Mitagation	**1.00**	**EA**	**166,667**	**0**	**166,667**

Description	**Quantity**	**UOM**	**DirectCost**	**SubCMU**	**PrimeCMU**	**ContractCost**
Contract Cost Summary Report			**187,816,186**	**0**	**39,425,269**	**227,241,455**
Phase 1	**1.00**	**LS**	**88,293,606**	**0**	**18,018,581**	**106,312,188**
General Conditions	**1.00**	**EA**	*815,924.36* **815,924**	**0**	**179,843**	*995,767.57* **995,768**
Temporary Office	**1.00**	**EA**	*47,015.46* **47,015**	**0**	**10,363**	*57,378.45* **57,378**
Submittals	**1.00**	**LS**	**32,102**	**0**	**7,076**	**39,178**
Mob and Demob	**1.00**	**LS**	**137,926**	**0**	**30,401**	**168,327**
Quality Control On-Site	**1.00**	**EA**	*598,881.40* **598,881**	**0**	**132,003**	*730,884.75* **730,885**
PZC 13 Combi-wall	**2,887.00**	**LF**	*17,165.26* **49,556,099**	**0**	**10,260,285**	*20,719.22* **59,816,384**
C King Pile (Beam)	**69,384.00**	**LF**	*266.83* **18,513,409**	**0**	**4,080,661**	*325.64* **22,594,070**
C PZC 13	**6,304.00**	**TON**	*2,383.98* **15,028,640**	**0**	**3,312,561**	*2,909.45* **18,341,200**
C Tie Rods	**236.00**	**EA**	*9,363.46* **2,209,777**	**0**	**487,071**	*11,427.32* **2,696,848**
C Wales	**756,395.00**	**LB**	*3.76* **2,845,656**	**0**	**627,230**	*4.59* **3,472,885**
C Concrete Cap	**6,950.00**	**CY**	*432.60* **3,006,570**	**0**	**0**	*432.60* **3,006,570**
Granular Fill	**515,000.00**	**TON**	*15.44* **7,952,048**	**0**	**1,752,763**	*18.84* **9,704,811**
Stone	**1.00**	**LS**	**28,406,937**	**0**	**6,261,359**	**34,668,296**
Type B	**42,545.00**	**TON**	*61.34* **2,609,633**	**0**	**575,206**	*74.86* **3,184,839**
Type C	**650,166.00**	**TON**	*34.74* **22,584,889**	**0**	**4,978,083**	*42.39* **27,562,972**
Type F	**128,300.00**	**TON**	*15.37* **1,972,062**	**0**	**434,675**	*18.76* **2,406,737**
Type H	**29,712.00**	**TON**	*41.75* **1,240,354**	**0**	**273,394**	*50.95* **1,513,748**

Description	Quantity	UOM	DirectCost	SubCMU	PrimeCMU	ContractCost
Weir and Walkway	1.00	EA	*36,936.02* 36,936	0	8,141	*45,077.32* 45,077
Wier	1.00	EA	*33,395.64* 33,396	0	7,361	*40,756.60* 40,757
Walkway, Railing and Ladder	1.00	EA	*3,540.37* 3,540	0	780	*4,320.73* 4,321
Fish Removal	1.00	EA	*35,000.00* 35,000	0	0	*35,000.00* 35,000
Outfall Relocation	2,670.00	LF	*1,250.00* 3,337,500	0	0	*1,250.00* 3,337,500
Precast Igloo Units	837.00	EA	*6,945.69* 5,813,543	0	1,281,401	*8,476.63* 7,094,943
Precast	837.00	EA	*6,705.54* 5,612,541	0	1,237,097	*8,183.56* 6,849,637
Setting in place	837.00	EA	*240.15* 201,002	0	44,304	*293.08* 245,306
Geotextile	25,000.00	SY	*5.00* 125,000	0	27,552	*6.10* 152,552
Mitagation	1.00	EA	*166,667.00* 166,667	0	0	*166,667.00* 166,667
Phase 2	1.00	LS	41,123,433	0	8,579,001	49,702,434
General Conditions	1.00	EA	*816,245.85* 816,246	0	179,914	*996,159.93* 996,160
Temporary Office	1.00	EA	*47,015.46* 47,015	0	10,363	*57,378.45* 57,378
Submittals	1.00	LS	32,102	0	7,076	39,178
Mob and Demob	1.00	LS	138,247	0	30,472	168,719
Quality Control On-Site	1.00	EA	*598,881.40* 598,881	0	132,003	*730,884.75* 730,885
Outfall Relocation	1,600.00	LF	*1,250.00* 2,000,000	0	0	*1,250.00* 2,000,000
Stone	1.00	LS	19,914,758	0	4,389,542	24,304,300

Description	Quantity	UOM	DirectCost	SubCMU	PrimeCMU	ContractCost
			61.28			*74.79*
Type B	**26,650.00**	**TON**	**1,633,151**	**0**	**359,973**	**1,993,125**
			34.68			*42.32*
Type C	**453,600.00**	**TON**	**15,731,029**	**0**	**3,467,379**	**19,198,408**
			15.31			*18.69*
Type F	**85,700.00**	**TON**	**1,312,410**	**0**	**289,277**	**1,601,687**
			41.69			*50.88*
Type H	**29,700.00**	**TON**	**1,238,168**	**0**	**272,913**	**1,511,081**
			36,936.02			*45,077.32*
Weir and Walkway	**1.00**	**EA**	**36,936**	**0**	**8,141**	**45,077**
			33,395.64			*40,756.60*
Wier	**1.00**	**EA**	**33,396**	**0**	**7,361**	**40,757**
			3,540.37			*4,320.73*
Walkway, Railing and Ladder	**1.00**	**EA**	**3,540**	**0**	**780**	**4,321**
			35,000.00			*35,000.00*
Fish Removal	**1.00**	**EA**	**35,000**	**0**	**0**	**35,000**
			6,945.69			*8,476.63*
Precast Igloo Units	**288.00**	**EA**	**2,000,359**	**0**	**440,912**	**2,441,271**
			6,705.54			*8,183.56*
Precast	**288.00**	**EA**	**1,931,197**	**0**	**425,668**	**2,356,864**
			240.15			*293.08*
Setting in place	**288.00**	**EA**	**69,162**	**0**	**15,244**	**84,406**
			16,836.09			*20,547.05*
PZC 13 Combi-wall	**955.00**	**LF**	**16,078,468**	**0**	**3,543,960**	**19,622,428**
			266.83			*325.64*
C King Pile (Beam)	**22,951.76**	**LF**	**6,124,110**	**0**	**1,349,855**	**7,473,965**
			2,383.98			*2,909.45*
C PZC 13	**2,085.32**	**TON**	**4,971,372**	**0**	**1,095,773**	**6,067,144**
			9,363.46			*11,427.32*
C Tie Rods	**78.07**	**EA**	**730,979**	**0**	**161,120**	**892,099**
			3.76			*4.59*
C Wales	**250,210.33**	**LB**	**941,324**	**0**	**207,483**	**1,148,807**
			432.60			*527.95*
C Concrete Cap	**2,299.01**	**CY**	**994,553**	**0**	**219,216**	**1,213,769**

Description	Quantity	UOM	DirectCost	SubCMU	PrimeCMU	ContractCost
Granular Fill	**150,000.00**	**TON**	*15.44* **2,316,131**	**0**	**510,513**	*18.84* **2,826,644**
Geotextile	**150,000.00**	**SY**	*0.50* **75,000**	**0**	**16,531**	*0.61* **91,531**
Mitagation	**1.00**	**EA**	*166,666.00* **166,666**	**0**	**0**	*166,666.00* **166,666**
Phase 3	**1.00**	**LS**	**58,399,147**	**0**	**12,827,686**	**71,226,834**
General Conditions	**1.00**	**EA**	*816,245.85* **816,246**	**0**	**179,914**	*996,159.93* **996,160**
Temporary Office	**1.00**	**EA**	*47,015.46* **47,015**	**0**	**10,363**	*57,378.45* **57,378**
Submittals	**1.00**	**LS**	**32,102**	**0**	**7,076**	**39,178**
Mob and Demob	**1.00**	**LS**	**138,247**	**0**	**30,472**	**168,719**
Quality Control On-Site	**1.00**	**EA**	*598,881.40* **598,881**	**0**	**132,003**	*730,884.75* **730,885**
Stone	**1.00**	**EA**	*17,251,987.88* **17,251,988**	**0**	**3,802,623**	*21,054,611.14* **21,054,611**
Type B	**20,600.00**	**TON**	*61.28* **1,262,398**	**0**	**278,253**	*74.79* **1,540,652**
Type C	**397,100.00**	**TON**	*34.68* **13,771,587**	**0**	**3,035,485**	*42.32* **16,807,072**
Type F	**79,500.00**	**TON**	*15.31* **1,217,463**	**0**	**268,349**	*18.69* **1,485,812**
Type H	**24,000.00**	**TON**	*41.69* **1,000,540**	**0**	**220,536**	*50.88* **1,221,076**
Fish Removal	**1.00**	**EA**	*35,000.00* **35,000**	**0**	**0**	*35,000.00* **35,000**
Weir and Walkway	**1.00**	**EA**	*36,936.02* **36,936**	**0**	**8,141**	*45,077.32* **45,077**
Wier	**1.00**	**EA**	*33,395.64* **33,396**	**0**	**7,361**	*40,756.60* **40,757**
Walkway, Railing and Ladder	**1.00**	**EA**	*3,540.37* **3,540**	**0**	**780**	*4,320.73* **4,321**

Description	Quantity	UOM	DirectCost	SubCMU	PrimeCMU	ContractCost
			6,945.69			*8,476.63*
Precast Igloo Units	**336.00**	**EA**	**2,333,752**	**0**	**514,397**	**2,848,149**
			6,705.54			*8,183.56*
Precast	**336.00**	**EA**	**2,253,063**	**0**	**496,612**	**2,749,675**
			240.15			*293.08*
Setting in place	**336.00**	**EA**	**80,689**	**0**	**17,785**	**98,474**
			15,993.33			*19,518.52*
PZC 13 Combi-wall	**2,314.00**	**LF**	**37,008,558**	**0**	**8,157,298**	**45,165,856**
			266.83			*325.64*
C King Pile (Beam)	**51,786.00**	**LF**	**13,817,816**	**0**	**3,045,675**	**16,863,492**
			2,370.53			*2,893.03*
C PZC 13	**5,052.81**	**TON**	**11,977,831**	**0**	**2,640,112**	**14,617,943**
			9,363.46			*11,427.32*
C Tie Rods	**189.16**	**EA**	**1,771,189**	**0**	**390,399**	**2,161,589**
			3.76			*4.59*
C Wales	**607,054.00**	**LB**	**2,283,816**	**0**	**503,391**	**2,787,206**
			432.60			*527.95*
C Concrete Cap	**5,570.59**	**CY**	**2,409,838**	**0**	**531,168**	**2,941,006**
			15.44			*18.84*
Granular Fill	**307,500.00**	**TON**	**4,748,068**	**0**	**1,046,553**	**5,794,620**
			50.00			*61.02*
Geotextile	**15,000.00**	**SY**	**750,000**	**0**	**165,312**	**915,312**
			166,667.00			*166,667.00*
Mitagation	**1.00**	**EA**	**166,667**	**0**	**0**	**166,667**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
Project Direct Costs Report			**18,407,592**	**20,034,879**	**132,758,944**	**46,800**	**11,853,461**	**1,450,000**	**3,264,509**	**187,816,186**
Phase 1	**1.00**	**LS**	**8,878,520**	**9,257,751**	**61,865,018**	**15,600**	**6,379,070**	**291,667**	**1,605,980**	**88,293,606**
(Note: Eastern section of entire CDF area from the West end of the Marina to the First Energy Outfall. Stone prices from Cleveland DMMP 2006 Estimates from Jim Dean.)										
			443,111.04	*247,586.04*	*31,600.00*	*15,600.00*			*78,027.28*	*815,924.36*
General Conditions	**1.00**	**EA**	**443,111**	**247,586**	**31,600**	**15,600**	**0**	**0**	**78,027**	**815,924**
			14,526.72	*0.00*	*14,400.00*	*15,600.00*			*2,488.74*	*47,015.46*
Temporary Office	**1.00**	**EA**	**14,527**	**0**	**14,400**	**15,600**	**0**	**0**	**2,489**	**47,015**
			0.00	*0.00*	*300.00*	*0.00*	*0.00*	*0.00*	*0.00*	*300.00*
AF 015205000550 Office Trailer, furnished, rent per month, 50' x 12', excl. hookups	36.00	MO	0	0	10,800	0	0	0	0	10,800
			0.00	*0.00*	*0.00*	*400.00*	*0.00*	*0.00*	*0.00*	*400.00*
USR Utility Costs	36.00	MO	0	0	0	14,400	0	0	0	14,400
(Note: Include Electric, Phone, Fax and Supplies)										
USR Mob and Demob Office Trailer	1.00	LS	0	0	0	1,200	0	0	0	1,200
			403.52	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*	*69.13*	*572.65*
USR Janitorial	36.00	MO	14,527	0	3,600	0	0	0	2,489	20,615
Submittals	**1.00**	**LS**	**18,683**	**0**	**10,000**	**0**	**0**	**0**	**3,419**	**32,102**
USR Reproduction and Mail	1.00	LS	0	0	10,000	0	0	0	0	10,000
			622.76	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*113.97*	*736.73*
USR Initial Project Submittals	30.00	DAY	18,683	0	0	0	0	0	3,419	22,102
Mob and Demob	**1.00**	**LS**	**47,396**	**81,930**	**0**	**0**	**0**	**0**	**8,600**	**137,926**
(Note: Assume 3 days initial mob + 2 days demob year 1 + 2 days mob year 2 + 2 days demob year 2 + year 3 (11 days @ 12 hrs/day))										
			157.71	*357.88*	*0.00*	*0.00*	*0.00*	*0.00*	*28.46*	*544.05*
USR 1 tug + 4 barges + 1 Eng + 1 Oper + 2 Tug Workers	132.00	HR	20,818	47,240	0	0	0	0	3,757	71,814
			201.35	*262.81*	*0.00*	*0.00*	*0.00*	*0.00*	*36.69*	*500.84*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
USR 1 Spud Barge + 1 Crane + 1 tug + 2 Oper + 2 Deck	132.00	HR	26,578	34,691	0	0	0	0	4,843	66,111
			362,505.60	*165,655.79*	*7,200.00*	*0.00*			*63,520.00*	*598,881.40*
Quality Control On-Site	**1.00**	**EA**	**362,506**	**165,656**	**7,200**	**0**	**0**	**0**	**63,520**	**598,881**
			10,069.60	*4,601.55*	*200.00*	*0.00*	*0.00*	*0.00*	*1,764.44*	*16,635.59*
USR Quality Control	36.00	MO	362,506	165,656	7,200	0	0	0	63,520	598,881
			1,309.92	*1,602.01*	*12,974.06*	*0.00*			*237.85*	*17,165.26*
PZC 13 Combi-wall	**2,887.00**	**LF**	**3,781,733**	**4,625,008**	**37,456,125**	**0**	**3,006,570**	**0**	**686,662**	**49,556,099**
(Note: First phase Combi-Wall approx.2887 lf Beam - W40 x 215 @ 73.45" (6.12') centers @ 66 feet long. Attached to the beams are connnectors welded to the beam for the PZC13 to insert into. PZC 13 @ 125-140 foot lengths. Anticipate that the sheet pile wall will be constructed after the west end of the breakwater is out of the water. Fill material should be available to be placed out to the location and as the wall is built the equipment should be able to be driven out onto the pier similar to the Chicago Shoreline Beach Piers.)										
			6.18	*5.12*	*254.40*	*0.00*			*1.12*	*266.83*
C King Pile (Beam)	**69,384.00**	**LF**	**428,888**	**355,237**	**17,651,245**	**0**	**0**	**0**	**78,039**	**18,513,409**
(Note: Includes BBS-M and BBS-F King piles are 66 feet in length. Lengths are on the high end for transportation purposes. From Civil/Structural Design assume that the lengths can be made and delivered without any splicing required at this point in the study.)										
			0.00	*0.00*	*2,165.00*	*0.00*	*0.00*	*0.00*	*0.00*	*2,165.00*
USR Material Price King Pile & connectors	8,153.00	TON	0	0	17,651,245	0	0	0	0	17,651,245
(Note: Connectors welded to pile.)										
			6.18	*5.12*	*0.00*	*0.00*	*0.00*	*0.00*	*1.12*	*12.43*
USR King pile installation	69,384.00	LF	428,888	355,237	0	0	0	0	78,039	862,164
(Note: Say 1 pile at 66 ft per hour due to tolerances.)										
			173.60	*143.79*	*2,035.00*	*0.00*			*31.59*	*2,383.98*
C PZC 13	**6,304.00**	**TON**	**1,094,401**	**906,465**	**12,828,640**	**0**	**0**	**0**	**199,133**	**15,028,640**
(Note: SSP piles are 125-140 feet in length. Lengths are on the high end for transportation purposes. From Civil/Structural Design assume that the lengths can be made and delivered without any splicing required at this point in the study.)										
			173.60	*143.79*	*0.00*	*0.00*	*0.00*	*0.00*	*31.59*	*348.98*
USR Steel Sheet Pile Installation	6,304.00	TON	1,094,401	906,465	0	0	0	0	199,133	2,200,000
(Note: 125 -140 foot sheets approx 2 ft wide @ say 2.0 sheets per hour = 250-280 sf/hr Reduce crew output due to need to thread in SSP at both sides and tight tolerances.)										

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			0.00	*0.00*	*2,035.00*	*0.00*	*0.00*	*0.00*	*0.00*	*2,035.00*
USR Material Price SSP	6,304.00	TON	0	0	12,828,640	0	0	0	0	12,828,640
			1,408.84	*1,198.28*	*6,500.00*	*0.00*			*256.34*	*9,363.46*
C Tie Rods	**236.00**	**EA**	**332,486**	**282,793**	**1,534,000**	**0**	**0**	**0**	**60,497**	**2,209,777**
			0.87	*0.74*	*4.00*	*0.00*	*0.00*	*0.00*	*0.16*	*5.76*
USR Wale & Tie Rod installation	383,500.00	LB	332,486	282,793	1,534,000	0	0	0	60,497	2,209,777
(Note: Reviewed the Chicago Shoreline beach job and price quote for wales @ $1.38/lb. Update due to current rates Use $2.00/lb ADJUST PRICE OF TIE RODS (DOUBLE THAT OF WALES).)										
			0.87	*0.74*	*2.00*	*0.00*			*0.16*	*3.76*
C Wales	**756,395.00**	**LB**	**655,778**	**557,766**	**1,512,790**	**0**	**0**	**0**	**119,322**	**2,845,656**
			0.87	*0.74*	*2.00*	*0.00*	*0.00*	*0.00*	*0.16*	*3.76*
USR Wale & Tie Rod installation	756,395.00	LB	655,778	557,766	1,512,790	0	0	0	119,322	2,845,656
(Note: Reviewed the Chicago Shoreline beach job and price quote for wales @ $1.38/lb. Update due to current rates Use $2.00/lb)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*432.60*
C Concrete Cap	**6,950.00**	**CY**	**0**	**0**	**0**	**0**	**3,006,570**	**0**	**0**	**3,006,570**
			0.00	*0.00*	*0.00*	*0.00*	*412.00*	*0.00*	*0.00*	*412.00*
USR Concrete Cap	7,297.50	CY	0	0	0	0	3,006,570	0	0	3,006,570
(Note: From Chicago Shoreline 40-41 beach estimate approx. $400/cy Updated using ENR June 08 - June 07 = 1.03 = $412/cy (includes reinforcing and formwork). Add 5% to Qty for waste. Leave contractor unassigned as bid abstract price includes OH & Profit.)										
			2.47	*4.90*	*7.63*	*0.00*			*0.45*	*15.44*
Granular Fill	**515,000.00**	**TON**	**1,270,180**	**2,522,747**	**3,929,450**	**0**	**0**	**0**	**229,672**	**7,952,048**
(Note: Use Type D material.)										
			0.71	*0.92*	*7.63*	*0.00*	*0.00*	*0.00*	*0.13*	*9.40*
USR Type D Stone	515,000.00	TON	367,728	474,897	3,929,450	0	0	0	66,809	4,838,884
(Note: (4" Minus) ODOT 703.19A Crushed Ag clev e brkwtr 30/ton)										
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.32*	*6.04*
USR Haul from Sandusky	515,000.00	TON	902,452	2,047,850	0	0	0	0	162,863	3,113,164
(Note: 2400 tons per trip, 24 hrs per trip)										
Stone	**1.00**	**LS**	**2,182,979**	**4,267,376**	**21,561,712**	**0**	**0**	**0**	**394,870**	**28,406,937**
			2.96	*5.52*	*52.32*	*0.00*			*0.54*	*61.34*
Type B	**42,545.00**	**TON**	**125,937**	**234,948**	**2,225,954**	**0**	**0**	**0**	**22,793**	**2,609,633**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			1.21	*1.55*	*52.32*	*0.00*	*0.00*	*0.00*	*0.22*	*55.29*
USR Type B Stone (600 lb to 2000 lb) Placed for CDF	42,545.00	TON	51,384	65,771	2,225,954	0	0	0	9,339	2,352,449
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.32*	*6.04*
USR Haul from Sandusky	42,545.00	TON	74,553	169,176	0	0	0	0	13,454	257,184
(Note: 2400 tons per cycle, 24 hrs per cycle)										
			2.56	*5.01*	*26.71*	*0.00*			*0.46*	*34.74*
Type C	**650,166.00**	**TON**	**1,662,806**	**3,255,396**	**17,365,934**	**0**	**0**	**0**	**300,753**	**22,584,889**
			0.81	*1.03*	*26.71*	*0.00*	*0.00*	*0.00*	*0.15*	*28.69*
USR Type C Stone	650,166.00	TON	523,498	670,071	17,365,934	0	0	0	95,145	18,654,649
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)										
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.32*	*6.04*
USR Haul from Sandusky	650,166.00	TON	1,139,308	2,585,325	0	0	0	0	205,608	3,930,240
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.45	*4.85*	*7.63*	*0.00*			*0.44*	*15.37*
Type F	**128,300.00**	**TON**	**313,796**	**622,567**	**978,929**	**0**	**0**	**0**	**56,770**	**1,972,062**
			0.69	*0.88*	*7.63*	*0.00*	*0.00*	*0.00*	*0.13*	*9.33*
USR Type F Stone	128,300.00	TON	88,972	112,394	978,929	0	0	0	16,197	1,196,491
(Note: (3/4" to 1") ODOT 703.01 Size No. 68 clev e brkwtr 20/ton)										
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.32*	*6.04*
USR Haul from Sandusky	128,300.00	TON	224,824	510,173	0	0	0	0	40,573	775,571
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.71	*5.20*	*33.35*	*0.00*			*0.49*	*41.75*
Type H	**29,712.00**	**TON**	**80,440**	**154,466**	**990,895**	**0**	**0**	**0**	**14,553**	**1,240,354**
			0.95	*1.22*	*33.35*	*0.00*	*0.00*	*0.00*	*0.17*	*35.70*
USR Type H Stone	29,712.00	TON	28,374	36,319	990,895	0	0	0	5,157	1,060,745
(Note: (6" - 18") ODOT 703.19B Type C)										
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.32*	*6.04*
USR Haul from Sandusky	29,712.00	TON	52,065	118,147	0	0	0	0	9,396	179,608
(Note: 2400 tons per trip, 24 hrs per trip)										

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			15,877.16	*14,720.56*	*3,516.80*	*0.00*			*2,821.50*	*36,936.02*
Weir and Walkway	**1.00**	**EA**	**15,877**	**14,721**	**3,517**	**0**	**0**	**0**	**2,821**	**36,936**
(Note: Quantities obtained from Dike 10b IGE dated June 1996)										
			14,682.72	*14,633.01*	*1,420.50*	*0.00*			*2,659.42*	*33,395.64*
Wier	**1.00**	**EA**	**14,683**	**14,633**	**1,421**	**0**	**0**	**0**	**2,659**	**33,396**
			16.31	*16.26*	*0.70*	*0.00*	*0.00*	*0.00*	*2.95*	*36.23*
MIL 031104300150 C.I.P. concrete forms, footing, continuous wall, plywood, 4 use, includes erecting, bracing, stripping and cleaning	300.00	SFC	4,894	4,878	210	0	0	0	886	10,868
			2,447.12	*2,438.83*	*541.50*	*0.00*	*0.00*	*0.00*	*443.24*	*5,870.69*
MIL 032106000700 Reinforcing steel, in place, walls, #3 to #7, A615, grade 60	1.00	TON	2,447	2,439	542	0	0	0	443	5,871
			407.85	*406.47*	*0.00*	*0.00*	*0.00*	*0.00*	*73.87*	*888.20*
USR 033107005400 Structural concrete, placing, walls, with crane and bucket, 15" thick, includes vibrating, excludes material	6.00	CY	2,447	2,439	0	0	0	0	443	5,329
			0.00	*0.00*	*110.00*	*0.00*	*0.00*	*0.00*	*0.00*	*110.00*
MIL 033102200300 Structural concrete, ready mix, normal weight, 4000 PSI, includes material only	6.00	CY	0	0	660	0	0	0	0	660
			16.31	*16.26*	*0.03*	*0.00*	*0.00*	*0.00*	*2.95*	*35.56*
MIL 033503500010 Concrete finishing, walls, includes breaking ties and patching voids	300.00	SF	4,894	4,878	9	0	0	0	886	10,667
			1,194.44	*87.55*	*2,096.30*	*0.00*			*162.08*	*3,540.37*
Walkway, Railing and Ladder	**1.00**	**EA**	**1,194**	**88**	**2,096**	**0**	**0**	**0**	**162**	**3,540**
			7.40	*0.42*	*13.92*	*0.00*	*0.00*	*0.00*	*1.00*	*22.74*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
RSM 055207000020 Railing, pipe, aluminum, satin finish, 2 rails, 1-1/4" dia	20.00	LF	148	8	278	0	0	0	20	455
			1.97	*0.11*	*8.86*	*0.00*	*0.00*	*0.00*	*0.27*	*11.21*
MIL 055303400694 Floor grating, steel, galvanized, 1-1/4" x 3/16" bearing bars @ 15/16" O.C., cross bars @ 4" O.C., 9.1 #/S.F., up to 300 S.F.	100.00	SF	197	11	886	0	0	0	27	1,121
			24.70	*2.38*	*4.40*	*0.00*	*0.00*	*0.00*	*3.35*	*34.84*
MIL 051204400672 Channel framing, structural steel, field fabricated, C8x11.5, incl cutting & welding	20.00	LF	494	48	88	0	0	0	67	697
			23.68	*1.35*	*56.26*	*0.00*	*0.00*	*0.00*	*3.21*	*84.50*
MIL 055145000020 Ladder, steel, 20" W, bolted to concrete, incl cage	15.00	VLF	355	20	844	0	0	0	48	1,267
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*35,000.00*
Fish Removal	**1.00**	**EA**	**0**	**0**	**0**	**0**	**35,000**	**0**	**0**	**35,000**
USR Fish Removal	1.00	LS	0	0	0	0	35,000	0	0	35,000
(Note: From Cleveland 10 B.)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*1,250.00*
Outfall Relocation	**2,670.00**	**LF**	**0**	**0**	**0**	**0**	**3,337,500**	**0**	**0**	**3,337,500**
(Note: Relocated First Energy Outfall 002 & 003. Outfalls to be relocated through the west arm of the first phase of the CDF. No sizes given. Assume the East 20 th street design from Cleveland 10b CDF.)										
			0.00	*0.00*	*0.00*	*0.00*	*1,250.00*	*0.00*	*0.00*	*1,250.00*
USR Outfall Relocation	2,670.00	LF	0	0	0	0	3,337,500	0	0	3,337,500
(Note: From Cleveland CDF 10B E20th Street outfall -171" x 110" Corr Steel Pipe Arch. Low Bidders unit Cost updated by ENR to current date. Unit price include OH & Profit. Leave assigned contractor as - (Unassigned).)										
			2,932.88	*123.13*	*3,359.69*	*0.00*			*529.99*	*6,945.69*
Precast Igloo Units	**837.00**	**EA**	**2,454,820**	**103,061**	**2,812,063**	**0**	**0**	**0**	**443,599**	**5,813,543**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			2,830.64	*3.90*	*3,359.69*	*0.00*			*511.31*	*6,705.54*
Precast	**837.00**	**EA**	**2,369,246**	**3,263**	**2,812,063**	**0**	**0**	**0**	**427,968**	**5,612,541**
(Note: Assume that this will be precast in a plant or on the dock where thecontractor will be setup. The data book does not have any units such as this in its database. Construct a single unit as it is on site in this folder. Next folder will deliver and place units. (Engineer not available to find out a manufacture and a internet surch found nothing, will talk with engineer when he becomes available.))										
			5.38	*0.00*	*0.59*	*0.00*	*0.00*	*0.00*	*0.98*	*6.94*
RSM 031104400120 C.I.P. concrete forms, mat foundation, plywood, 4 use, includes erecting, bracing, stripping and cleaning	187,655.40	SFC	1,008,664	0	110,717	0	0	0	183,832	1,303,213
			0.48	*0.00*	*0.44*	*0.00*	*0.00*	*0.00*	*0.09*	*1.00*
RSM 032106000210 Reinforcing steel, in place, columns, alternate method, #3 to #7, A615, grade 60, incl access. Labor	2,577,960.00	LB	1,226,696	0	1,134,302	0	0	0	219,736	2,580,735
			0.00	*0.00*	*91.00*	*0.00*	*0.00*	*0.00*	*0.00*	*91.00*
RSM 033102200300 Structural concrete, ready mix, normal weight, 4000 PSI, includes material only	17,158.50	CY	0	0	1,561,424	0	0	0	0	1,561,424
			4.79	*0.19*	*0.00*	*0.00*	*0.00*	*0.00*	*0.88*	*5.86*
RSM 033107002900 Structural concrete, placing, foundation mat, direct chute, over 20 C.Y., includes vibrating, excludes material	17,158.50	CY	82,227	3,263	0	0	0	0	15,049	100,539
			0.45	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.08*	*0.54*
RSM 033503000100 Concrete finishing, floors, monolithic, screed and bull float(darby) finish	101,277.00	SF	45,942	0	0	0	0	0	8,303	54,245
			5.64	*0.00*	*5.55*	*0.00*	*0.00*	*0.00*	*1.04*	*12.23*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
HNC 033902000305 Curing, sprayed membrane compound	1,012.77	CSF	5,716	0	5,621	0	0	0	1,049	12,385
			102.24	*119.23*	*0.00*	*0.00*			*18.67*	*240.15*
Setting in place	**837.00**	**EA**	**85,574**	**99,798**	**0**	**0**	**0**	**0**	**15,631**	**201,002**
(Note: It is assumed that most of this alternative will be built by land plant. Due to tha amount of units (including weight of units) that will be required to transport over the top of the new structure, it is envisioned taht the units will be loadedonto barges transported to the site and the units placed by a crane on a barge.)										
			26.62	*26.22*	*0.00*	*0.00*	*0.00*	*0.00*	*4.88*	*57.72*
USR Unload from trucks	837.00	EA	22,278	21,942	0	0	0	0	4,088	48,308
(Note: Say 5 units/per hour (One every 10 min.- 50 min Hr) =.2 hr)										
			26.62	*26.22*	*0.00*	*0.00*	*0.00*	*0.00*	*4.88*	*57.72*
USR Loading onto barges	837.00	EA	22,278	21,942	0	0	0	0	4,088	48,308
(Note: land crane loading barges Say 5 units/per hour (One every 10 min. 50 min Hr)=.2 hr)										
			4.68	*10.07*	*0.00*	*0.00*	*0.00*	*0.00*	*0.85*	*15.60*
USR Yard Crane	837.00	HR	3,921	8,428	0	0	0	0	712	13,060
(Note: Yard Crane to move igloos around. Will be used on an as need basis. For purpose fo estimate Say will move 10 unts per hour. 1452/10 = 145 hrs)										
			3.26	*4.17*	*0.00*	*0.00*	*0.00*	*0.00*	*0.59*	*8.02*
USR Travel to site	837.00	HR	2,728	3,492	0	0	0	0	496	6,715
(Note: Say staging area to be in the marina area Say .5 hrs to travel to placement site. 1100 ton barge/17.5 ton each unit = 63 units each 1152 total units / 63 units each =18 trips x .5 hrs each = 9 hrs x 2 (return) = 18 hrs Use ~ 20 hrs. (24 hrs calculated))										
			41.06	*52.56*	*0.00*	*0.00*	*0.00*	*0.00*	*7.46*	*101.09*
USR Place units on site	837.00	EA	34,371	43,994	0	0	0	0	6,247	84,611
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*5.00*
Geotextile	**25,000.00**	**SY**	**0**	**0**	**0**	**0**	**0**	**125,000**	**0**	**125,000**
			0.00	*0.00*	*0.00*	*0.00*	*0.00*	*5.00*	*0.00*	*5.00*
USR Geotextile	25,000.00	SY	0	0	0	0	0	125,000	0	125,000
(Note: Estimaors judgement from past projects.)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*166,667.00*
Mitagation	**1.00**	**EA**	**0**	**0**	**0**	**0**	**0**	**166,667**	**0**	**166,667**
USR Mitagation	1.00	LS	0	0	0	0	0	166,667	0	166,667
(Note: Per PM Mitagation costs from Friends of Chicago River project escalated to the scope of this project. Leave contractor unassigned.)										
Phase 2	**1.00**	**LS**	**4,033,687**	**4,716,575**	**28,391,975**	**15,600**	**3,029,553**	**241,666**	**694,378**	**41,123,433**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
(Note: Eastern section of entire CDF area from the West end of the Marina to the First Energy Outfall. Stone prices from Cleveland DMMP 2006 Estimates from Jim Dean.)										
General Conditions	**1.00**	**EA**	*443,394.84* **443,395**	*247,586.04* **247,586**	*31,600.00* **31,600**	*15,600.00* **15,600**	**0**	**0**	*78,064.98* **78,065**	*816,245.85* **816,246**
Temporary Office	**1.00**	**EA**	*14,526.72* **14,527**	*0.00* **0**	*14,400.00* **14,400**	*15,600.00* **15,600**	**0**	**0**	*2,488.74* **2,489**	*47,015.46* **47,015**
AF 015205000550 Office Trailer, furnished, rent per month, 50' x 12', excl. hookups	36.00	MO	*0.00* 0	*0.00* 0	*300.00* 10,800	*0.00* 0	*0.00* 0	*0.00* 0	*0.00* 0	*300.00* 10,800
USR Utility Costs	36.00	MO	*0.00* 0	*0.00* 0	*0.00* 0	*400.00* 14,400	*0.00* 0	*0.00* 0	*0.00* 0	*400.00* 14,400
(Note: Include Electric, Phone, Fax and Supplies)										
USR Mob and Demob Office Trailer	1.00	LS	0	0	0	1,200	0	0	0	1,200
USR Janitorial	36.00	MO	*403.52* 14,527	*0.00* 0	*100.00* 3,600	*0.00* 0	*0.00* 0	*0.00* 0	*69.13* 2,489	*572.65* 20,615
Submittals	**1.00**	**LS**	**18,683**	**0**	**10,000**	**0**	**0**	**0**	**3,419**	**32,102**
USR Reproduction and Mail	1.00	LS	0	0	10,000	0	0	0	0	10,000
USR Initial Project Submittals	30.00	DAY	*622.76* 18,683	*0.00* 0	*0.00* 0	*0.00* 0	*0.00* 0	*0.00* 0	*113.97* 3,419	*736.73* 22,102
Mob and Demob	**1.00**	**LS**	**47,680**	**81,930**	**0**	**0**	**0**	**0**	**8,637**	**138,247**
(Note: Assume 3 days initial mob + 2 days demob year 1 + 2 days mob year 2 + 2 days demob year 2 + year 3 (11 days @ 12 hrs/day))										
USR 1 tug + 4 barges + 1 Eng + 1 Oper + 2 Tug Workers	132.00	HR	*157.71* 20,818	*357.88* 47,240	*0.00* 0	*0.00* 0	*0.00* 0	*0.00* 0	*28.46* 3,757	*544.05* 71,814
USR 1 Spud Barge + 1 Crane + 1 tug + 2 Oper + 2 Deck	132.00	HR	*203.50* 26,862	*262.81* 34,691	*0.00* 0	*0.00* 0	*0.00* 0	*0.00* 0	*36.97* 4,880	*503.28* 66,433
			362,505.60	*165,655.79*	*7,200.00*	*0.00*			*63,520.00*	*598,881.40*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
Quality Control On-Site	**1.00**	**EA**	**362,506**	**165,656**	**7,200**	**0**	**0**	**0**	**63,520**	**598,881**
			10,069.60	*4,601.55*	*200.00*	*0.00*	*0.00*	*0.00*	*1,764.44*	*16,635.59*
USR Quality Control	36.00	MO	362,506	165,656	7,200	0	0	0	63,520	598,881
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*1,250.00*
Outfall Relocation	**1,600.00**	**LF**	**0**	**0**	**0**	**0**	**2,000,000**	**0**	**0**	**2,000,000**
(Note: Relocated First Energy Outfall 203. Outfall to be relocated through the west arm of the first phase of the CDF. No sizes given. Assume the East 20 th street design from Cleveland 10b CDF.)										
			0.00	*0.00*	*0.00*	*0.00*	*1,250.00*	*0.00*	*0.00*	*1,250.00*
USR Outfall Relocation	1,600.00	LF	0	0	0	0	2,000,000	0	0	2,000,000
(Note: From Cleveland CDF 10B E20th Street outfall -171" x 110" Corr Steel Pipe Arch. Low Bidders unit Cost updated by ENR to current date. Unit price include OH & Profit. Leave assigned contractor as - (Unassigned).)										
Stone	**1.00**	**LS**	**1,528,985**	**2,988,612**	**15,154,370**	**0**	**0**	**0**	**242,791**	**19,914,758**
			2.96	*5.52*	*52.32*	*0.00*			*0.48*	*61.28*
Type B	**26,650.00**	**TON**	**78,887**	**147,170**	**1,394,328**	**0**	**0**	**0**	**12,766**	**1,633,151**
			1.21	*1.55*	*52.32*	*0.00*	*0.00*	*0.00*	*0.22*	*55.29*
USR Type B Stone (600 lb to 2000 lb) Placed for CDF	26,650.00	TON	32,187	41,199	1,394,328	0	0	0	5,850	1,473,564
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.26*	*5.99*
USR Haul from Sandusky	26,650.00	TON	46,700	105,971	0	0	0	0	6,916	159,587
(Note: 2400 tons per cycle, 24 hrs per cycle)										
			2.56	*5.01*	*26.71*	*0.00*			*0.41*	*34.68*
Type C	**453,600.00**	**TON**	**1,160,086**	**2,271,186**	**12,115,656**	**0**	**0**	**0**	**184,101**	**15,731,029**
			0.81	*1.03*	*26.71*	*0.00*	*0.00*	*0.00*	*0.15*	*28.69*
USR Type C Stone	453,600.00	TON	365,228	467,487	12,115,656	0	0	0	66,380	13,014,751
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)										
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.26*	*5.99*
USR Haul from Sandusky	453,600.00	TON	794,858	1,803,698	0	0	0	0	117,721	2,716,278
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.45	*4.85*	*7.63*	*0.00*			*0.39*	*15.31*
Type F	**85,700.00**	**TON**	**209,605**	**415,853**	**653,891**	**0**	**0**	**0**	**33,060**	**1,312,410**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			0.69	*0.88*	*7.63*	*0.00*	*0.00*	*0.00*	*0.13*	*9.33*
USR Type F Stone	85,700.00	TON	59,430	75,075	653,891	0	0	0	10,819	799,215
(Note: (3/4" to 1") ODOT 703.01 Size No. 68 clev e brkwtr 20/ton)										
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.26*	*5.99*
USR Haul from Sandusky	85,700.00	TON	150,175	340,778	0	0	0	0	22,241	513,194
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.71	*5.20*	*33.35*	*0.00*			*0.43*	*41.69*
Type H	**29,700.00**	**TON**	**80,407**	**154,403**	**990,495**	**0**	**0**	**0**	**12,863**	**1,238,168**
			0.95	*1.22*	*33.35*	*0.00*	*0.00*	*0.00*	*0.17*	*35.70*
USR Type H Stone	29,700.00	TON	28,363	36,304	990,495	0	0	0	5,155	1,060,317
(Note: (6" - 18") ODOT 703.19B Type C)										
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.26*	*5.99*
USR Haul from Sandusky	29,700.00	TON	52,044	118,099	0	0	0	0	7,708	177,852
(Note: 2400 tons per trip, 24 hrs per trip)										
			15,877.16	*14,720.56*	*3,516.80*	*0.00*			*2,821.50*	*36,936.02*
Weir and Walkway	**1.00**	**EA**	**15,877**	**14,721**	**3,517**	**0**	**0**	**0**	**2,821**	**36,936**
(Note: Quantities obtained from Dike 10b IGE dated June 1996)										
			14,682.72	*14,633.01*	*1,420.50*	*0.00*			*2,659.42*	*33,395.64*
Wier	**1.00**	**EA**	**14,683**	**14,633**	**1,421**	**0**	**0**	**0**	**2,659**	**33,396**
			16.31	*16.26*	*0.70*	*0.00*	*0.00*	*0.00*	*2.95*	*36.23*
MIL 031104300150 C.I.P. concrete forms, footing, continuous wall, plywood, 4 use, includes erecting, bracing, stripping and cleaning	300.00	SFC	4,894	4,878	210	0	0	0	886	10,868
			2,447.12	*2,438.83*	*541.50*	*0.00*	*0.00*	*0.00*	*443.24*	*5,870.69*
MIL 032106000700 Reinforcing steel, in place, walls, #3 to #7, A615, grade 60	1.00	TON	2,447	2,439	542	0	0	0	443	5,871
			407.85	*406.47*	*0.00*	*0.00*	*0.00*	*0.00*	*73.87*	*888.20*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
USR 033107005400 Structural concrete, placing, walls, with crane and bucket, 15" thick, includes vibrating, excludes material	6.00	CY	2,447	2,439	0	0	0	0	443	5,329
			0.00	*0.00*	*110.00*	*0.00*	*0.00*	*0.00*	*0.00*	*110.00*
MIL 033102200300 Structural concrete, ready mix, normal weight, 4000 PSI, includes material only	6.00	CY	0	0	660	0	0	0	0	660
			16.31	*16.26*	*0.03*	*0.00*	*0.00*	*0.00*	*2.95*	*35.56*
MIL 033503500010 Concrete finishing, walls, includes breaking ties and patching voids	300.00	SF	4,894	4,878	9	0	0	0	886	10,667
			1,194.44	*87.55*	*2,096.30*	*0.00*			*162.08*	*3,540.37*
Walkway, Railing and Ladder	**1.00**	**EA**	**1,194**	**88**	**2,096**	**0**	**0**	**0**	**162**	**3,540**
			7.40	*0.42*	*13.92*	*0.00*	*0.00*	*0.00*	*1.00*	*22.74*
RSM 055207000020 Railing, pipe, aluminum, satin finish, 2 rails, 1-1/4" dia	20.00	LF	148	8	278	0	0	0	20	455
			1.97	*0.11*	*8.86*	*0.00*	*0.00*	*0.00*	*0.27*	*11.21*
MIL 055303400694 Floor grating, steel, galvanized, 1-1/4" x 3/16" bearing bars @ 15/16" O.C., cross bars @ 4" O.C., 9.1 #/S.F., up to 300 S.F.	100.00	SF	197	11	886	0	0	0	27	1,121
			24.70	*2.38*	*4.40*	*0.00*	*0.00*	*0.00*	*3.35*	*34.84*
MIL 051204400672 Channel framing, structural steel, field fabricated, C8x11.5, incl cutting & welding	20.00	LF	494	48	88	0	0	0	67	697
			23.68	*1.35*	*56.26*	*0.00*	*0.00*	*0.00*	*3.21*	*84.50*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
MIL 055145000020 Ladder, steel, 20" W, bolted to concrete, incl cage	15.00	VLF	355	20	844	0	0	0	48	1,267
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*35,000.00*
Fish Removal	**1.00**	**EA**	**0**	**0**	**0**	**0**	**35,000**	**0**	**0**	**35,000**
USR Fish Removal	1.00	LS	0	0	0	0	35,000	0	0	35,000
(Note: From Cleveland 10 B.)										
			2,932.88	*123.13*	*3,359.69*	*0.00*			*529.99*	*6,945.69*
Precast Igloo Units	**288.00**	**EA**	**844,669**	**35,462**	**967,592**	**0**	**0**	**0**	**152,636**	**2,000,359**
			2,830.64	*3.90*	*3,359.69*	*0.00*			*511.31*	*6,705.54*
Precast	**288.00**	**EA**	**815,224**	**1,123**	**967,592**	**0**	**0**	**0**	**147,258**	**1,931,197**
(Note: Assume that this will be precast in a plant or on the dock where thecontractor will be setup. The data book does not have any units such as this in its database. Construct a single unit as it is on site in this folder. Next folder will deliver and place units. (Engineer not available to find out a manufacture and a internet surch found nothing, will talk with engineer when he becomes available.))										
			5.38	*0.00*	*0.59*	*0.00*	*0.00*	*0.00*	*0.98*	*6.94*
RSM 031104400120 C.I.P. concrete forms, mat foundation, plywood, 4 use, includes erecting, bracing, stripping and cleaning	64,569.60	SFC	347,067	0	38,096	0	0	0	63,254	448,417
			0.48	*0.00*	*0.44*	*0.00*	*0.00*	*0.00*	*0.09*	*1.00*
RSM 032106000210 Reinforcing steel, in place, columns, alternate method, #3 to #7, A615, grade 60, incl access. Labor	887,040.00	LB	422,089	0	390,298	0	0	0	75,608	887,995
			0.00	*0.00*	*91.00*	*0.00*	*0.00*	*0.00*	*0.00*	*91.00*
RSM 033102200300 Structural concrete, ready mix, normal weight, 4000 PSI, includes material only	5,904.00	CY	0	0	537,264	0	0	0	0	537,264
			4.79	*0.19*	*0.00*	*0.00*	*0.00*	*0.00*	*0.88*	*5.86*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
RSM 033107002900 Structural concrete, placing, foundation mat, direct chute, over 20 C.Y., includes vibrating, excludes material	5,904.00	CY	28,293	1,123	0	0	0	0	5,178	34,594
			0.45	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.08*	*0.54*
RSM 033503000100 Concrete finishing, floors, monolithic, screed and bull float(darby) finish	34,848.00	SF	15,808	0	0	0	0	0	2,857	18,665
			5.64	*0.00*	*5.55*	*0.00*	*0.00*	*0.00*	*1.04*	*12.23*
HNC 033902000305 Curing, sprayed membrane compound	348.48	CSF	1,967	0	1,934	0	0	0	361	4,262
			102.24	*119.23*	*0.00*	*0.00*			*18.67*	*240.15*
Setting in place	**288.00**	**EA**	**29,445**	**34,339**	**0**	**0**	**0**	**0**	**5,378**	**69,162**
(Note: It is assumed that most of this alternative will be built by land plant. Due to tha amount of units (including weight of units) that will be required to transport over the top of the new structure, it is envisioned taht the units will be loadedonto barges transported to the site and the units placed by a crane on a barge.)										
			26.62	*26.22*	*0.00*	*0.00*	*0.00*	*0.00*	*4.88*	*57.72*
USR Unload from trucks	288.00	EA	7,665	7,550	0	0	0	0	1,407	16,622
(Note: Say 5 units/per hour (One every 10 min.- 50 min Hr) =.2 hr)										
			26.62	*26.22*	*0.00*	*0.00*	*0.00*	*0.00*	*4.88*	*57.72*
USR Loading onto barges	288.00	EA	7,665	7,550	0	0	0	0	1,407	16,622
(Note: land crane loading barges Say 5 units/per hour (One every 10 min. 50 min Hr)=.2 hr)										
			4.68	*10.07*	*0.00*	*0.00*	*0.00*	*0.00*	*0.85*	*15.60*
USR Yard Crane	288.00	HR	1,349	2,900	0	0	0	0	245	4,494
(Note: Yard Crane to move igloos around. Will be used on an as need basis. For purpose fo estimate Say will move 10 unts per hour. 1452/10 = 145 hrs)										
			3.26	*4.17*	*0.00*	*0.00*	*0.00*	*0.00*	*0.59*	*8.02*
USR Travel to site	288.00	HR	939	1,201	0	0	0	0	171	2,311
(Note: Say staging area to be in the marina area Say .5 hrs to travel to placement site. 1100 ton barge/17.5 ton each unit = 63 units each 1152 total units / 63 units each =18 trips x .5 hrs each = 9 hrs x 2 (return) = 18 hrs Use ~ 20 hrs. (24 hrs calculated))										
			41.06	*52.56*	*0.00*	*0.00*	*0.00*	*0.00*	*7.46*	*101.09*
USR Place units on site	288.00	EA	11,826	15,138	0	0	0	0	2,149	29,114

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			1,257.34	*1,497.59*	*12,811.41*	*0.00*			*228.34*	*16,836.09*
PZC 13 Combi-wall	**955.00**	**LF**	**1,200,760**	**1,430,194**	**12,234,896**	**0**	**994,553**	**0**	**218,064**	**16,078,468**
(Note: First phase Combi-Wall approx.2887 lf Beam - W40 x 215 @ 73.45" (6.12') centers @ 66 feet long. Attached to the beams are connnectors welded to the beam for the PZC13 to insert into. PZC 13 @ 125-140 foot lengths. Anticipate that the sheet pile wall will be constructed after the west end of the breakwater is out of the water. Fill material should be available to be placed out to the location and as the wall is built the equipment should be able to be driven out onto the pier similar to the Chicago Shoreline Beach Piers.)										
			6.18	*5.12*	*254.40*	*0.00*			*1.12*	*266.83*
C King Pile (Beam)	**22,951.76**	**LF**	**141,873**	**117,510**	**5,838,912**	**0**	**0**	**0**	**25,815**	**6,124,110**
(Note: Includes BBS-M and BBS-F King piles are 66 feet in length. Lengths are on the high end for transportation purposes. From Civil/Structural Design assume that the lengths can be made and delivered without any splicing required at this point in the study.)										
			0.00	*0.00*	*2,165.00*	*0.00*	*0.00*	*0.00*	*0.00*	*2,165.00*
USR Material Price King Pile & connectors	2,696.96	TON	0	0	5,838,912	0	0	0	0	5,838,912
(Note: Connectors welded to pile.)										
			6.18	*5.12*	*0.00*	*0.00*	*0.00*	*0.00*	*1.12*	*12.43*
USR King pile installation	22,951.76	LF	141,873	117,510	0	0	0	0	25,815	285,198
(Note: Say 1 pile at 66 ft per hour due to tolerances.)										
			173.60	*143.79*	*2,035.00*	*0.00*			*31.59*	*2,383.98*
C PZC 13	**2,085.32**	**TON**	**362,020**	**299,853**	**4,243,627**	**0**	**0**	**0**	**65,872**	**4,971,372**
(Note: SSP piles are 125-140 feet in length. Lengths are on the high end for transportation purposes. From Civil/Structural Design assume that the lengths can be made and delivered without any splicing required at this point in the study.)										
			173.60	*143.79*	*0.00*	*0.00*	*0.00*	*0.00*	*31.59*	*348.98*
USR Steel Sheet Pile Installation	2,085.32	TON	362,020	299,853	0	0	0	0	65,872	727,745
(Note: 125 -140 foot sheets approx 2 ft wide @ say 2.0 sheets per hour = 250-280 sf/hr Reduce crew output due to need to thread in SSP at both sides and tight tolerances.)										
			0.00	*0.00*	*2,035.00*	*0.00*	*0.00*	*0.00*	*0.00*	*2,035.00*
USR Material Price SSP	2,085.32	TON	0	0	4,243,627	0	0	0	0	4,243,627
			1,408.84	*1,198.28*	*6,500.00*	*0.00*			*256.34*	*9,363.46*
C Tie Rods	**78.07**	**EA**	**109,984**	**93,546**	**507,437**	**0**	**0**	**0**	**20,012**	**730,979**
			0.87	*0.74*	*4.00*	*0.00*	*0.00*	*0.00*	*0.16*	*5.76*
USR Wale & Tie Rod installation	126,859.20	LB	109,984	93,546	507,437	0	0	0	20,012	730,979
(Note: Reviewed the Chicago Shoreline beach job and price quote for wales @ $1.38/lb. Update due to current rates Use $2.00/lb ADJUST PRICE OF TIE RODS (DOUBLE THAT OF WALES).)										

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			0.87	*0.74*	*2.00*	*0.00*			*0.16*	*3.76*
C Wales	**250,210.33**	**LB**	**216,927**	**184,505**	**500,421**	**0**	**0**	**0**	**39,471**	**941,324**
			0.87	*0.74*	*2.00*	*0.00*	*0.00*	*0.00*	*0.16*	*3.76*
USR Wale & Tie Rod installation	250,210.33	LB	216,927	184,505	500,421	0	0	0	39,471	941,324
(Note: Reviewed the Chicago Shoreline beach job and price quote for wales @ $1.38/lb. Update due to current rates Use $2.00/lb)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*432.60*
C Concrete Cap	**2,299.01**	**CY**	**0**	**0**	**0**	**0**	**994,553**	**0**	**0**	**994,553**
			0.00	*0.00*	*0.00*	*0.00*	*412.00*	*0.00*	*0.00*	*412.00*
USR Concrete Cap	2,413.96	CY	0	0	0	0	994,553	0	0	994,553
(Note: From Chicago Shoreline 40-41 beach estimate approx. $400/cy Updated using ENR June 08 - June 07 = 1.03 = $412/cy (includes reinforcing and formwork). Add 5% to Qty for waste. Leave contractor unassigned as bid abstract price includes OH & Profit.)										
			2.47	*4.90*	*7.63*	*0.00*			*0.45*	*15.44*
Granular Fill	**150,000.00**	**TON**	**369,955**	**734,781**	**1,144,500**	**0**	**0**	**0**	**66,895**	**2,316,131**
(Note: Use Type D material.)										
			0.71	*0.92*	*7.63*	*0.00*	*0.00*	*0.00*	*0.13*	*9.40*
USR Type D Stone	150,000.00	TON	107,105	138,319	1,144,500	0	0	0	19,459	1,409,384
(Note: (4" Minus) ODOT 703.19A Crushed Ag clev e brkwtr 30/ton)										
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.32*	*6.04*
USR Haul from Sandusky	150,000.00	TON	262,850	596,461	0	0	0	0	47,436	906,747
(Note: 2400 tons per trip, 24 hrs per trip)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*0.50*
Geotextile	**150,000.00**	**SY**	**0**	**0**	**0**	**0**	**0**	**75,000**	**0**	**75,000**
			0.00	*0.00*	*0.00*	*0.00*	*0.00*	*5.00*	*0.00*	*5.00*
USR Geotextile	15,000.00	SY	0	0	0	0	0	75,000	0	75,000
(Note: Estimaors judgement from past projects.)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*166,666.00*
Mitagation	**1.00**	**EA**	**0**	**0**	**0**	**0**	**0**	**166,666**	**0**	**166,666**
USR Mitagation	1.00	LS	0	0	0	0	0	166,666	0	166,666
(Note: Per PM Mitagation costs from Friends of Chicago River project escalated to the scope of this project. Leave contractor unassigned.)										
Phase 3	**1.00**	**LS**	**5,495,386**	**6,060,553**	**42,501,952**	**15,600**	**2,444,838**	**916,667**	**964,152**	**58,399,147**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
(Note: Eastern section of entire CDF area from the West end of the Marina to the First Energy Outfall. Stone prices from Cleveland DMMP 2006 Estimates from Jim Dean.)										
			443,394.84	*247,586.04*	*31,600.00*	*15,600.00*			*78,064.98*	*816,245.85*
General Conditions	**1.00**	**EA**	**443,395**	**247,586**	**31,600**	**15,600**	**0**	**0**	**78,065**	**816,246**
			14,526.72	*0.00*	*14,400.00*	*15,600.00*			*2,488.74*	*47,015.46*
Temporary Office	**1.00**	**EA**	**14,527**	**0**	**14,400**	**15,600**	**0**	**0**	**2,489**	**47,015**
			0.00	*0.00*	*300.00*	*0.00*	*0.00*	*0.00*	*0.00*	*300.00*
AF 015205000550 Office Trailer, furnished, rent per month, 50' x 12', excl. hookups	36.00	MO	0	0	10,800	0	0	0	0	10,800
			0.00	*0.00*	*0.00*	*400.00*	*0.00*	*0.00*	*0.00*	*400.00*
USR Utility Costs	36.00	MO	0	0	0	14,400	0	0	0	14,400
(Note: Include Electric, Phone, Fax and Supplies)										
USR Mob and Demob Office Trailer	1.00	LS	0	0	0	1,200	0	0	0	1,200
			403.52	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*	*69.13*	*572.65*
USR Janitorial	36.00	MO	14,527	0	3,600	0	0	0	2,489	20,615
Submittals	**1.00**	**LS**	**18,683**	**0**	**10,000**	**0**	**0**	**0**	**3,419**	**32,102**
USR Reproduction and Mail	1.00	LS	0	0	10,000	0	0	0	0	10,000
			622.76	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*113.97*	*736.73*
USR Initial Project Submittals	30.00	DAY	18,683	0	0	0	0	0	3,419	22,102
Mob and Demob	**1.00**	**LS**	**47,680**	**81,930**	**0**	**0**	**0**	**0**	**8,637**	**138,247**
(Note: Assume 3 days initial mob + 2 days demob year 1 + 2 days mob year 2 + 2 days demob year 2 + year 3 (11 days @ 12 hrs/day))										
			157.71	*357.88*	*0.00*	*0.00*	*0.00*	*0.00*	*28.46*	*544.05*
USR 1 tug + 4 barges + 1 Eng + 1 Oper + 2 Tug Workers	132.00	HR	20,818	47,240	0	0	0	0	3,757	71,814
			203.50	*262.81*	*0.00*	*0.00*	*0.00*	*0.00*	*36.97*	*503.28*
USR 1 Spud Barge + 1 Crane + 1 tug + 2 Oper + 2 Deck	132.00	HR	26,862	34,691	0	0	0	0	4,880	66,433
			362,505.60	*165,655.79*	*7,200.00*	*0.00*			*63,520.00*	*598,881.40*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
Quality Control On-Site	**1.00**	**EA**	**362,506**	**165,656**	**7,200**	**0**	**0**	**0**	**63,520**	**598,881**
			10,069.60	*4,601.55*	*200.00*	*0.00*	*0.00*	*0.00*	*1,764.44*	*16,635.59*
USR Quality Control	36.00	MO	362,506	165,656	7,200	0	0	0	63,520	598,881
			1,335,981.70	*2,612,587.36*	*13,091,318.00*	*0.00*			*212,100.82*	*17,251,987.88*
Stone	**1.00**	**EA**	**1,335,982**	**2,612,587**	**13,091,318**	**0**	**0**	**0**	**212,101**	**17,251,988**
			2.96	*5.52*	*52.32*	*0.00*			*0.48*	*61.28*
Type B	**20,600.00**	**TON**	**60,978**	**113,760**	**1,077,792**	**0**	**0**	**0**	**9,868**	**1,262,398**
			1.21	*1.55*	*52.32*	*0.00*	*0.00*	*0.00*	*0.22*	*55.29*
USR Type B Stone (600 lb to 2000 lb) Placed for CDF	20,600.00	TON	24,880	31,846	1,077,792	0	0	0	4,522	1,139,040
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.26*	*5.99*
USR Haul from Sandusky	20,600.00	TON	36,098	81,914	0	0	0	0	5,346	123,358
(Note: 2400 tons per cycle, 24 hrs per cycle)										
			2.56	*5.01*	*26.71*	*0.00*			*0.41*	*34.68*
Type C	**397,100.00**	**TON**	**1,015,587**	**1,988,289**	**10,606,541**	**0**	**0**	**0**	**161,170**	**13,771,587**
			0.81	*1.03*	*26.71*	*0.00*	*0.00*	*0.00*	*0.15*	*28.69*
USR Type C Stone	397,100.00	TON	319,736	409,258	10,606,541	0	0	0	58,112	11,393,646
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)										
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.26*	*5.99*
USR Haul from Sandusky	397,100.00	TON	695,852	1,579,031	0	0	0	0	103,058	2,377,941
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.45	*4.85*	*7.63*	*0.00*			*0.39*	*15.31*
Type F	**79,500.00**	**TON**	**194,441**	**385,768**	**606,585**	**0**	**0**	**0**	**30,669**	**1,217,463**
			0.69	*0.88*	*7.63*	*0.00*	*0.00*	*0.00*	*0.13*	*9.33*
USR Type F Stone	79,500.00	TON	55,131	69,644	606,585	0	0	0	10,036	741,396
(Note: (3/4" to 1") ODOT 703.01 Size No. 68 clev e brkwtr 20/ton)										
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.26*	*5.99*
USR Haul from Sandusky	79,500.00	TON	139,310	316,124	0	0	0	0	20,632	476,067
(Note: 2400 tons per trip, 24 hrs per trip)										

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			2.71	*5.20*	*33.35*	*0.00*			*0.43*	*41.69*
Type H	**24,000.00**	**TON**	**64,975**	**124,770**	**800,400**	**0**	**0**	**0**	**10,394**	**1,000,540**
			0.95	*1.22*	*33.35*	*0.00*	*0.00*	*0.00*	*0.17*	*35.70*
USR Type H Stone	24,000.00	TON	22,919	29,337	800,400	0	0	0	4,166	856,822
(Note: (6" - 18") ODOT 703.19B Type C)										
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.26*	*5.99*
USR Haul from Sandusky	24,000.00	TON	42,056	95,434	0	0	0	0	6,229	143,718
(Note: 2400 tons per trip, 24 hrs per trip)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*35,000.00*
Fish Removal	**1.00**	**EA**	**0**	**0**	**0**	**0**	**35,000**	**0**	**0**	**35,000**
USR Fish Removal	1.00	LS	0	0	0	0	35,000	0	0	35,000
(Note: From Cleveland 10 B.)										
			15,877.16	*14,720.56*	*3,516.80*	*0.00*			*2,821.50*	*36,936.02*
Weir and Walkway	**1.00**	**EA**	**15,877**	**14,721**	**3,517**	**0**	**0**	**0**	**2,821**	**36,936**
(Note: Quantities obtained from Dike 10b IGE dated June 1996)										
			14,682.72	*14,633.01*	*1,420.50*	*0.00*			*2,659.42*	*33,395.64*
Wier	**1.00**	**EA**	**14,683**	**14,633**	**1,421**	**0**	**0**	**0**	**2,659**	**33,396**
			16.31	*16.26*	*0.70*	*0.00*	*0.00*	*0.00*	*2.95*	*36.23*
MIL 031104300150 C.I.P. concrete forms, footing, continuous wall, plywood, 4 use, includes erecting, bracing, stripping and cleaning	300.00	SFC	4,894	4,878	210	0	0	0	886	10,868
			2,447.12	*2,438.83*	*541.50*	*0.00*	*0.00*	*0.00*	*443.24*	*5,870.69*
MIL 032106000700 Reinforcing steel, in place, walls, #3 to #7, A615, grade 60	1.00	TON	2,447	2,439	542	0	0	0	443	5,871
			407.85	*406.47*	*0.00*	*0.00*	*0.00*	*0.00*	*73.87*	*888.20*
USR 033107005400 Structural concrete, placing, walls, with crane and bucket, 15" thick, includes vibrating, excludes material	6.00	CY	2,447	2,439	0	0	0	0	443	5,329

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			0.00	*0.00*	*110.00*	*0.00*	*0.00*	*0.00*	*0.00*	*110.00*
MIL 033102200300 Structural concrete, ready mix, normal weight, 4000 PSI, includes material only	6.00	CY	0	0	660	0	0	0	0	660
			16.31	*16.26*	*0.03*	*0.00*	*0.00*	*0.00*	*2.95*	*35.56*
MIL 033503500010 Concrete finishing, walls, includes breaking ties and patching voids	300.00	SF	4,894	4,878	9	0	0	0	886	10,667
			1,194.44	*87.55*	*2,096.30*	*0.00*			*162.08*	*3,540.37*
Walkway, Railing and Ladder	**1.00**	**EA**	**1,194**	**88**	**2,096**	**0**	**0**	**0**	**162**	**3,540**
			7.40	*0.42*	*13.92*	*0.00*	*0.00*	*0.00*	*1.00*	*22.74*
RSM 055207000020 Railing, pipe, aluminum, satin finish, 2 rails, 1-1/4" dia	20.00	LF	148	8	278	0	0	0	20	455
			1.97	*0.11*	*8.86*	*0.00*	*0.00*	*0.00*	*0.27*	*11.21*
MIL 055303400694 Floor grating, steel, galvanized, 1-1/4" x 3/16" bearing bars @ 15/16" O.C., cross bars @ 4" O.C., 9.1 #/S.F., up to 300 S.F.	100.00	SF	197	11	886	0	0	0	27	1,121
			24.70	*2.38*	*4.40*	*0.00*	*0.00*	*0.00*	*3.35*	*34.84*
MIL 051204400672 Channel framing, structural steel, field fabricated, C8x11.5, incl cutting & welding	20.00	LF	494	48	88	0	0	0	67	697
			23.68	*1.35*	*56.26*	*0.00*	*0.00*	*0.00*	*3.21*	*84.50*
MIL 055145000020 Ladder, steel, 20" W, bolted to concrete, incl cage	15.00	VLF	355	20	844	0	0	0	48	1,267
			2,932.88	*123.13*	*3,359.69*	*0.00*			*529.99*	*6,945.69*
Precast Igloo Units	**336.00**	**EA**	**985,447**	**41,372**	**1,128,857**	**0**	**0**	**0**	**178,076**	**2,333,752**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			2,830.64	*3.90*	*3,359.69*	*0.00*			*511.31*	*6,705.54*
Precast	**336.00**	**EA**	**951,095**	**1,310**	**1,128,857**	**0**	**0**	**0**	**171,801**	**2,253,063**
			5.38	*0.00*	*0.59*	*0.00*	*0.00*	*0.00*	*0.98*	*6.94*
RSM 031104400120 C.I.P. concrete forms, mat foundation, plywood, 4 use, includes erecting, bracing, stripping and cleaning	75,331.20	SFC	404,912	0	44,445	0	0	0	73,797	523,154
			0.48	*0.00*	*0.44*	*0.00*	*0.00*	*0.00*	*0.09*	*1.00*
RSM 032106000210 Reinforcing steel, in place, columns, alternate method, #3 to #7, A615, grade 60, incl access. Labor	1,034,880.00	LB	492,437	0	455,347	0	0	0	88,209	1,035,994
			0.00	*0.00*	*91.00*	*0.00*	*0.00*	*0.00*	*0.00*	*91.00*
RSM 033102200300 Structural concrete, ready mix, normal weight, 4000 PSI, includes material only	6,888.00	CY	0	0	626,808	0	0	0	0	626,808
			4.79	*0.19*	*0.00*	*0.00*	*0.00*	*0.00*	*0.88*	*5.86*
RSM 033107002900 Structural concrete, placing, foundation mat, direct chute, over 20 C.Y., includes vibrating, excludes material	6,888.00	CY	33,009	1,310	0	0	0	0	6,041	40,360
			0.45	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.08*	*0.54*
RSM 033503000100 Concrete finishing, floors, monolithic, screed and bull float(darby) finish	40,656.00	SF	18,443	0	0	0	0	0	3,333	21,776
			5.64	*0.00*	*5.55*	*0.00*	*0.00*	*0.00*	*1.04*	*12.23*

(Note: Assume that this will be precast in a plant or on the dock where thecontractor will be setup. The data book does not have any units such as this in its database. Construct a single unit as it is on site in this folder. Next folder will deliver and place units. (Engineer not available to find out a manufacture and a internet surch found nothing, will talk with engineer when he becomes available.))

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
HNC 033902000305 Curing, sprayed membrane compound	406.56	CSF	2,295	0	2,256	0	0	0	421	4,972
			102.24	*119.23*	*0.00*	*0.00*			*18.67*	*240.15*
Setting in place	**336.00**	**EA**	**34,352**	**40,062**	**0**	**0**	**0**	**0**	**6,275**	**80,689**
(Note: It is assumed that most of this alternative will be built by land plant. Due to tha amount of units (including weight of units) that will be required to transport over the top of the new structure, it is envisioned taht the units will be loadedonto barges transported to the site and the units placed by a crane on a barge.)										
			26.62	*26.22*	*0.00*	*0.00*	*0.00*	*0.00*	*4.88*	*57.72*
USR Unload from trucks	336.00	EA	8,943	8,808	0	0	0	0	1,641	19,392
(Note: Say 5 units/per hour (One every 10 min.- 50 min Hr) =.2 hr)										
			26.62	*26.22*	*0.00*	*0.00*	*0.00*	*0.00*	*4.88*	*57.72*
USR Loading onto barges	336.00	EA	8,943	8,808	0	0	0	0	1,641	19,392
(Note: land crane loading barges Say 5 units/per hour (One every 10 min. 50 min Hr)=.2 hr)										
			4.68	*10.07*	*0.00*	*0.00*	*0.00*	*0.00*	*0.85*	*15.60*
USR Yard Crane	336.00	HR	1,574	3,383	0	0	0	0	286	5,243
(Note: Yard Crane to move igloos around. Will be used on an as need basis. For purpose fo estimate Say will move 10 unts per hour. 1452/10 = 145 hrs)										
			3.26	*4.17*	*0.00*	*0.00*	*0.00*	*0.00*	*0.59*	*8.02*
USR Travel to site	336.00	HR	1,095	1,402	0	0	0	0	199	2,696
(Note: Say staging area to be in the marina area Say .5 hrs to travel to placement site. 1100 ton barge/17.5 ton each unit = 63 units each 1152 total units / 63 units each =18 trips x .5 hrs each = 9 hrs x 2 (return) = 18 hrs Use ~ 20 hrs. (24 hrs calculated))										
			41.06	*52.56*	*0.00*	*0.00*	*0.00*	*0.00*	*7.46*	*101.09*
USR Place units on site	336.00	EA	13,798	17,661	0	0	0	0	2,508	33,966
			1,173.16	*1,358.81*	*12,206.85*	*0.00*			*213.09*	*15,993.33*
PZC 13 Combi-wall	**2,314.00**	**LF**	**2,714,684**	**3,144,287**	**28,246,660**	**0**	**2,409,838**	**0**	**493,089**	**37,008,558**
(Note: Beam - W40 x 215 @ 73.45" (6.12') centers @ 66 feet long. Attached to the beams are connnectors welded to the beam for the PZC13 to insert into. PZC 13 @ 125-140 foot lengths. Anticipate that the sheet pile wall will be constructed after the west end of the breakwater is out of the water. Fill material should be available to be placed out to the location and as the wall is built the equipment should be able to be driven out onto the pier similar to the Chicago Shoreline Beach Piers.)										
			6.18	*5.12*	*254.40*	*0.00*			*1.12*	*266.83*
C King Pile (Beam)	**51,786.00**	**LF**	**320,108**	**265,138**	**13,174,325**	**0**	**0**	**0**	**58,246**	**13,817,816**
(Note: Includes BBS-M and BBS-F King piles are 66 feet in length. Lengths are on the high end for transportation purposes. From Civil/Structural Design assume that the lengths can be made and delivered without any splicing required at this point in the study.)										

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			0.00	*0.00*	*2,165.00*	*0.00*	*0.00*	*0.00*	*0.00*	*2,165.00*
USR Material Price King Pile & connectors	6,085.14	TON	0	0	13,174,325	0	0	0	0	13,174,325
(Note: Connectors welded to pile.)										
			6.18	*5.12*	*0.00*	*0.00*	*0.00*	*0.00*	*1.12*	*12.43*
USR King pile installation	51,786.00	LF	320,108	265,138	0	0	0	0	58,246	643,491
(Note: Say 1 pile at 66 ft per hour due to tolerances.)										
			166.91	*138.25*	*2,035.00*	*0.00*			*30.37*	*2,370.53*
C PZC 13	**5,052.81**	**TON**	**843,369**	**698,542**	**10,282,464**	**0**	**0**	**0**	**153,456**	**11,977,831**
(Note: SSP piles are 125-140 feet in length. Lengths are on the high end for transportation purposes. From Civil/Structural Design assume that the lengths can be made and delivered without any splicing required at this point in the study.)										
			173.60	*143.79*	*0.00*	*0.00*	*0.00*	*0.00*	*31.59*	*348.98*
USR Steel Sheet Pile Installation	4,858.00	TON	843,369	698,542	0	0	0	0	153,456	1,695,368
(Note: 125 -140 foot sheets approx 2 ft wide @ say 2.0 sheets per hour = 250-280 sf/hr Reduce crew output due to need to thread in SSP at both sides and tight tolerances.)										
			0.00	*0.00*	*2,035.00*	*0.00*	*0.00*	*0.00*	*0.00*	*2,035.00*
USR Material Price SSP	5,052.81	TON	0	0	10,282,464	0	0	0	0	10,282,464
			1,408.84	*1,198.28*	*6,500.00*	*0.00*			*256.34*	*9,363.46*
C Tie Rods	**189.16**	**EA**	**266,496**	**226,665**	**1,229,538**	**0**	**0**	**0**	**48,490**	**1,771,189**
			0.87	*0.74*	*4.00*	*0.00*	*0.00*	*0.00*	*0.16*	*5.76*
USR Wale & Tie Rod installation	307,384.48	LB	266,496	226,665	1,229,538	0	0	0	48,490	1,771,189
(Note: Reviewed the Chicago Shoreline beach job and price quote for wales @ $1.38/lb. Update due to current rates Use $2.00/lb ADJUST PRICE OF TIE RODS (DOUBLE THAT OF WALES).)										
			0.87	*0.74*	*2.00*	*0.00*			*0.16*	*3.76*
C Wales	**607,054.00**	**LB**	**526,303**	**447,642**	**1,214,108**	**0**	**0**	**0**	**95,763**	**2,283,816**
			0.87	*0.74*	*2.00*	*0.00*	*0.00*	*0.00*	*0.16*	*3.76*
USR Wale & Tie Rod installation	607,054.00	LB	526,303	447,642	1,214,108	0	0	0	95,763	2,283,816
(Note: Reviewed the Chicago Shoreline beach job and price quote for wales @ $1.38/lb. Update due to current rates Use $2.00/lb)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*432.60*
C Concrete Cap	**5,570.59**	**CY**	**0**	**0**	**0**	**0**	**2,409,838**	**0**	**0**	**2,409,838**
			0.00	*0.00*	*0.00*	*0.00*	*412.00*	*0.00*	*0.00*	*412.00*
USR Concrete Cap	5,849.12	CY	0	0	0	0	2,409,838	0	0	2,409,838

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
(Note: From Chicago Shoreline 40-41 beach estimate approx. $400/cy Updated using ENR June 08 - June 07 = 1.03 = $412/cy (includes reinforcing and formwork). Add 5% to Qty for waste. Leave contractor unassigned as bid abstract price includes OH & Profit.)										
			2.47	*4.90*	*7.63*	*0.00*			*0.45*	*15.44*
Granular Fill	**307,500.00**	**TON**	**758,408**	**1,506,300**	**2,346,225**	**0**	**0**	**0**	**137,134**	**4,748,068**
(Note: Use Type D material.)										
			0.71	*0.92*	*7.63*	*0.00*	*0.00*	*0.00*	*0.13*	*9.40*
USR Type D Stone	307,500.00	TON	219,566	283,555	2,346,225	0	0	0	39,891	2,889,237
(Note: (4" Minus) ODOT 703.19A Crushed Ag clev e brkwtr 30/ton)										
			1.75	*3.98*	*0.00*	*0.00*	*0.00*	*0.00*	*0.32*	*6.04*
USR Haul from Sandusky	307,500.00	TON	538,842	1,222,745	0	0	0	0	97,243	1,858,831
(Note: 2400 tons per trip, 24 hrs per trip)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*50.00*
Geotextile	**15,000.00**	**SY**	**0**	**0**	**0**	**0**	**0**	**750,000**	**0**	**750,000**
			0.00	*0.00*	*0.00*	*0.00*	*0.00*	*5.00*	*0.00*	*5.00*
USR Geotextile	150,000.00	SY	0	0	0	0	0	750,000	0	750,000
(Note: Estimaors judgement from past projects.)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*166,667.00*
Mitagation	**1.00**	**EA**	**0**	**0**	**0**	**0**	**0**	**166,667**	**0**	**166,667**
USR Mitagation	1.00	LS	0	0	0	0	0	166,667	0	166,667
(Note: Per PM Mitagation costs from Friends of Chicago River project escalated to the scope of this project. Leave contractor unassigned.)										

Description **Page**

Description **Page**

Description **Page**

Tab G
Supplemental analysis of the National Economic Development Plan

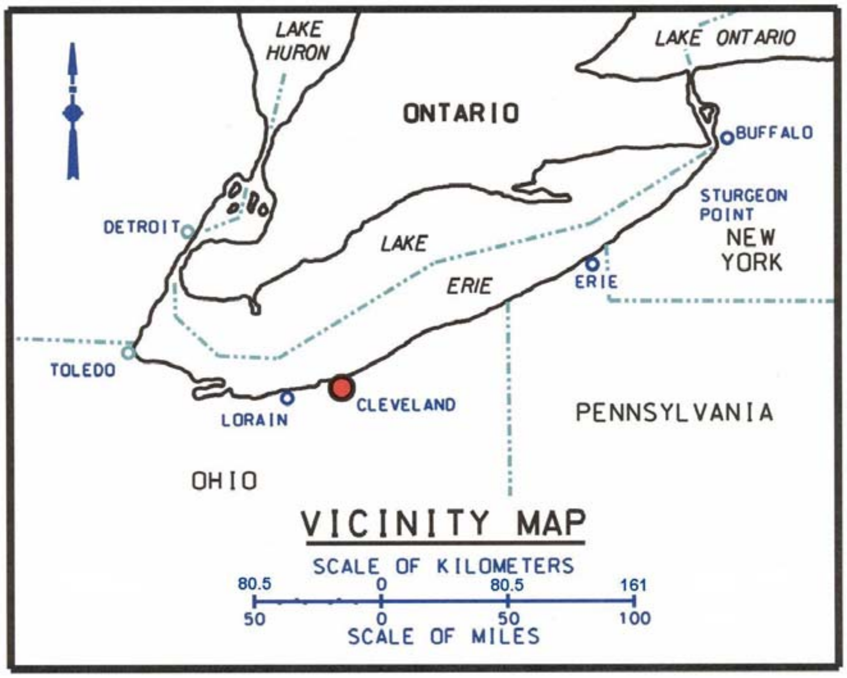
CLEVELAND E55th STREET CONFINED DISPOSAL FACILITY

FEDERAL STANDARD PLAN DEVELOPMENT

SUMMARY

1. INTRODUCTION

Cleveland Harbor, Cuyahoga County, Ohio, is located on the south shore of Lake Erie at the mouth of the Cuyahoga River. The port is 28 miles east of Lorain, Ohio and 33 miles west of Fairport, Ohio (Insert 1). Cleveland Harbor is a major commercial port on Lake Erie, but suffers the lack of dredged material disposal capacity which is needed to continue the operation and economic viability of Cleveland as a commercial navigation port on the Great Lakes. Based on 2006 data of total tonnage handled, Cleveland Harbor is the 5th busiest port on the Great Lakes and 44th busiest port in the nation (USACE-IWR, 2008)[1]. Inherent in the operations and maintenance of any port is maintenance dredging and disposal of dredged materials from the commercial navigation channels and dredging and disposal by local port interests. Complicating the need for dredging and dredged material disposal at Cleveland is the fact that most if not all sediments dredged are considered ‘contaminated’ and generally have to be confined in some environmentally acceptable manner.



Insert 1 – Location of Cleveland Harbor, Ohio

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[1] USACE-IWR, Cubic Yard Tonnage Statistics for Selected U.S. Ports by Port Name. Institute of Water Resources, U.S. Army Corps of Engineers, Washington D.C. 2006. http://www.iwr.usace.army.mil/ndc/wcsc/portton03.htm.

Past and current practice for dredged sediment disposal in Cleveland has been to dispose of materials in stone dike enclosures called confined disposal facilities (CDFs) constructed along the Cleveland waterfront. Once filled or in some instances partially filled, the dikes are turned over to the owner for future disposition. At the conclusion of the 2008 dredging season, it is expected that all existing CDFs at Cleveland, barring the implementation of CDF management measures, will be filled to capacity. From 2008 through 2014, it is expected that sufficient additional capacity can be obtained at the existing Cleveland CDFs using fill management plans (FMP) internal to the CDFs (e.g. dewatering, consolidation of dredged material, construction of internal berms). By the year 2015, a new disposal facility or method will have to be in place in order to continue dredging Cleveland Harbor.[2]

As described in USACE (2008)[3], an analysis of potential CDF sites was investigated. The analysis followed the USACE six-step planning process and started with identifying problems and opportunities, establishing study objectives (both national and local), and identifying planning constraints. Fourteen individual measures were identified including beneficial use, best management practices, and construction of a new CDF. The measures were assessed and, if viable, carried forward into detailed planning and analysis. The analysis included potential social, economic, and environmental benefits and impacts that would result from each alternative plan. A total of six alternative plans were developed.

The tentatively selected plan was Alternative Plan 4a (FMP and East 55th Street site, Insert 2). Alternative 4a is the locally preferred plan because the more robust perimeter bulkheads make the site more suitable for relocating maritime port facilities once the CDF is filled and transferred to the sponsor. The non-Federal sponsor understands that all costs above that of the NED are borne entirely by the non-Federal sponsor and indicate as such in their Letter of Intent. Therefore, the tentatively selected plan is the locally preferred plan.

Construction costs for Plan 4a are $275,800,800. Construction of Cell 1 would take place in approximately 25 feet of water, be constructed over a three year period (2012, 2013, 2014), and cost $128,900,000. Construction of Cell 2 would take place in approximately 28 feet of water, be constructed over a three year period (2019, 2020, 2021), and cost $60,700,000. Construction of Cell 3 would take place in approximately 28 feet of water, be constructed over a three year period (2024, 2025, 2026), and cost $86,200,000.[4]

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[2] USACE. 2008. Cleveland Harbor Draft Dredged Material Management Plan, Chapter 1, Introduction, U.S. Army Corps of Engineers, Buffalo, NY.

[3] USACE. 2008. Cleveland Harbor Draft Dredged Material Management Plan, Executive Summary, U.S. Army Corps of Engineers, Buffalo, NY.

[4] USACE. 2008. Cleveland Harbor Draft Dredged Material Management Plan, Appendix A, Base Plan, U.S. Army Corps of Engineers, Buffalo, NY.

Insert 2. Proposed CDF

It is noted that the proposed footprint of the East 55th Street site encroaches on the existing Federal approach channel in the east basin and eastern flared portion of the 25-foot deep dock approach channel to the former Nicholson Cleveland Terminal Company pier. These portions of the existing project were authorized but never constructed. These portions of the channel must be de-authorized in order to implement the proposed East 55th Street CDF alternative.

As a result of the Plan 4a encroaching into the Federal channel, USACE Washington requested that USACE Buffalo redesign the selected plan to minimize encroachment into the Federal channel.[5] It was specifically stated, "As a facet of the plan formulation process, the footprint, volume, height, and other general design features of the proposed confined disposal facility (CDF) at the East 55th Street site should be reanalyzed without constraints by future land-use desires/requirements of the non-Federal sponsor." This report summarizes those efforts.

2. ALTERNATIVES

Plan 4a was redesigned based upon the following criteria:

- Minimize encroachment into the Federal navigation channel,
- Set the proposed fill elevation at +20 ft LWD, and
- Achieve a 20-year capacity assuming a fill rate of 330,000 cubic yards per year.

Two alternatives were developed, using stone and steel sheet pile as the primary construction materials.

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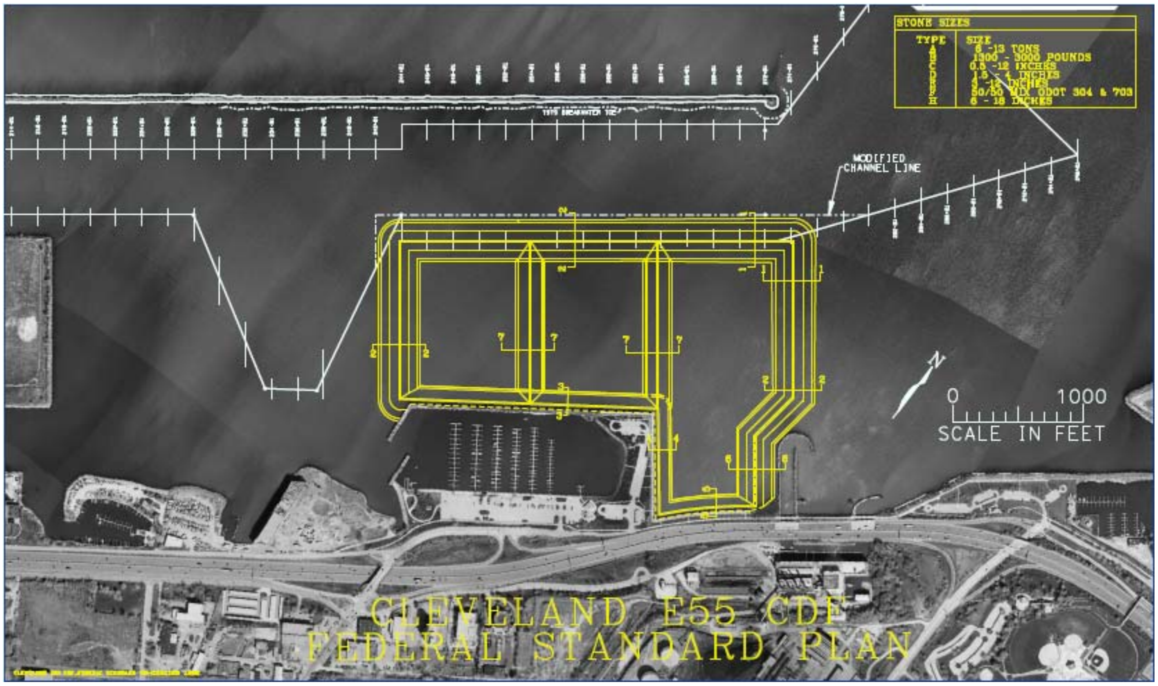
[5] CECW-LRD. 2009. Memorandum through Commander Great Lakes and Ohio River Division, Subject: Cleveland Harbor Dredged Material Management Plan, Cuyahoga County, OH, dated 29-APR-2009.

A. **Rubble Mound Alternative** - For the rubble mound alternative, typical stone cross-sections for the existing CDF at Dike 14 and the proposed Site 2 were assumed applicable to this site. Due to the presence of very weak soils, wide stability berms will be required and up to 8 feet of average settlement is expected. It is assumed that the facility will be constructed in three phases, with the construction progressing east to west. In order to achieve approximately a 20-year capacity, two iterations of the footprint were required. The first iteration assumed minimal encroachment into the eastern flared portion of the 25-foot deep dock approach channel to the former Nicholson Cleveland Terminal Company pier and the Federal channel line was modified as shown in Insert 3. The stone toe was placed at 25 feet from the modified channel line.

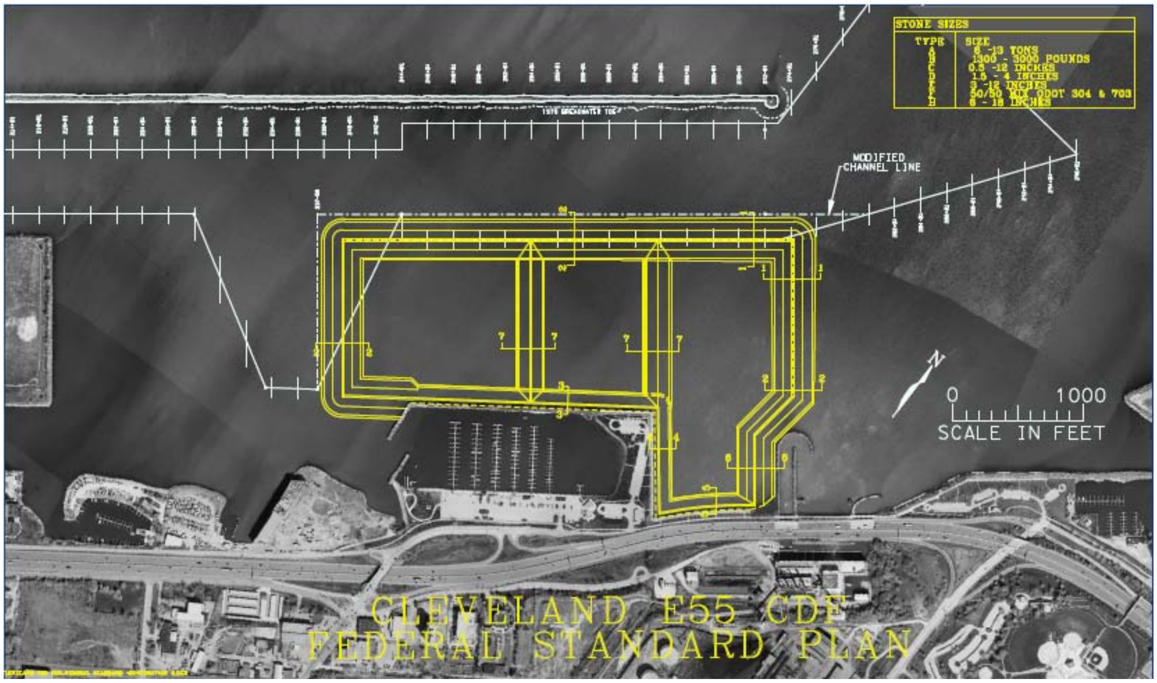


Insert 3. E55th CDF, Rubble Mound Alternative, Iteration 1

The potential interior volume of the CDF was determined by estimating the volume occupied by area delineated by the sheet pile line or the back of the structure crest defined by existing structures and subsequently subtracting the volume occupied by the stone structures. The gross volume was determined by generating a digital terrain model (DTM) for the existing bottom, based upon surveys obtained in 2008 and the top elevation of the CDF at 20 feet LWD. Subtracting these two DTMs resulted in the gross volume within the CDF. Further subtraction of the volume occupied by the stone structures resulted in a net volume of 6,181,000 cubic yards. At an average fill rate of 330,000 cubic yards annually, the facility would reach capacity at 18.7 years.

In order to achieve a 20-year capacity, the layout was modified by moving the west leg westward, further encroaching into the eastern flared portion of the

25-foot deep dock approach channel to the former Nicholson Cleveland Terminal Company pier as shown in Insert 4. The potential volume was determined in the same manner as iteration 1 and is summarized in Table 1. It is estimated that this configuration would result in a potential volume of 6,532,000 cubic yards and a capacity of 19.8 years. This is the selected rubble mound configuration. Figures 1 – 5 present the plan and typical cross-sections.

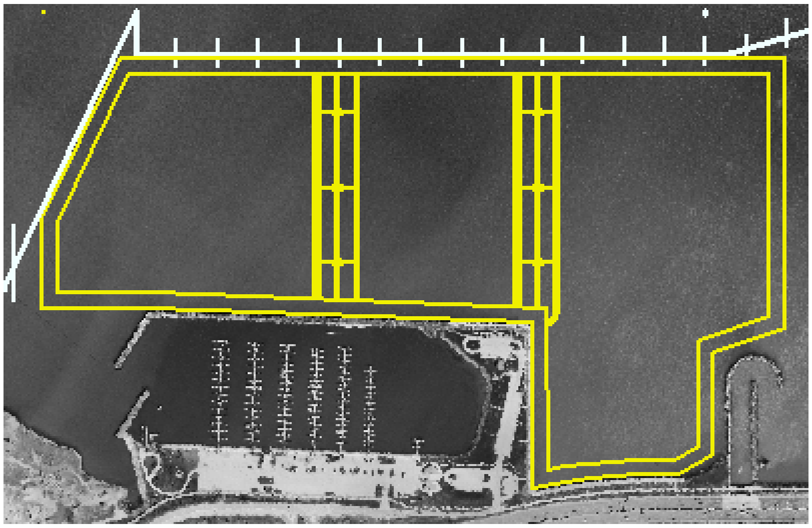


Insert 4. E55th CDF, Rubble Mound Alternative, Iteration 2

Table 1. Net Volume for Iteration 2, Rubble Mound Alternative

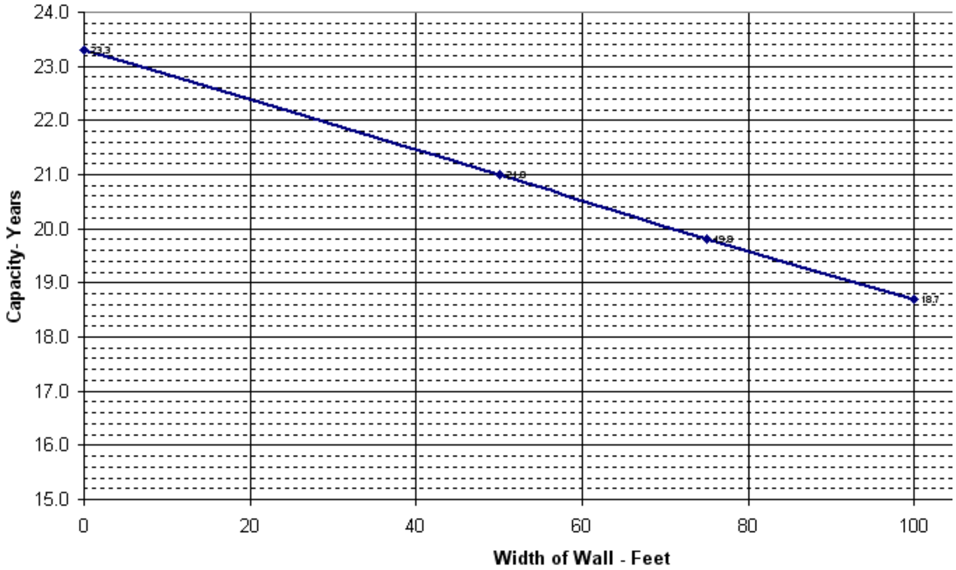
Item	Volume - CY
Volume delineated by sheet pile or backline of crest along existing structures	7924173
Deductions of stone from	
North Leg	344858
West Leg	105205
Marina Leg	262673
Bikepath Leg	57760
East Leg	201535
Cross dikes	420311
TOTAL Deductions	1392342
NET CDF Volume	**6,531,831**
Capacity (Years)	**19.8**

B. Steel Combi-wall Alternative – For this alternative, a combi-wall configuration was selected. Combi-walls are piling walls comprised of high modulus structural components interspaced by lighter sheet piles. It was initially assumed that the crest elevation would be +22 ft LWD and the wall would be placed 25-feet from the existing Federal navigation line as shown in Insert 5.



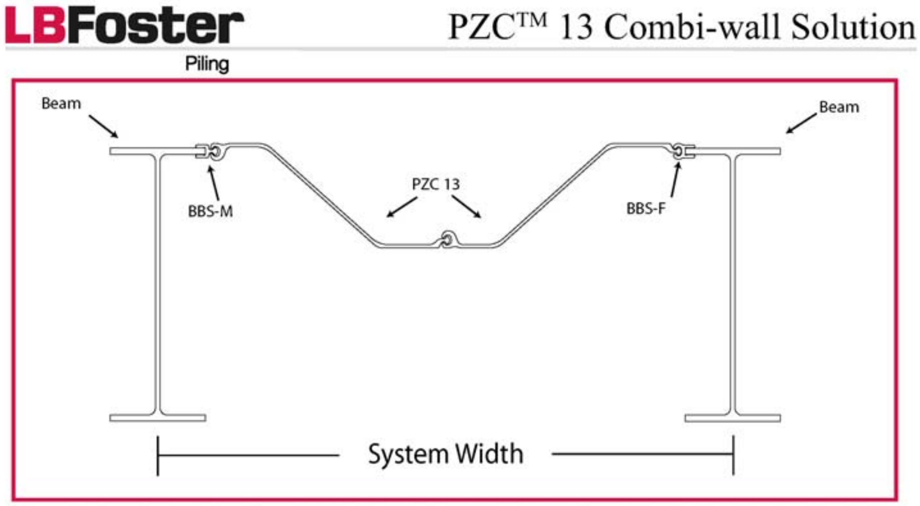
Insert 5. E55th CDF, Combi-wall Alternative, Iteration 1

The volume of the CDF filled to +20 ft LWD was determined by subtracting the volume occupied by the stone cross dikes from the volume contained within the combiwall system. Insert 6 presents a graph of the net CDF volume for varying combi-wall system widths and suggests that the basic footprint will support the placement of about 20 years of dredge material.



Insert 6. CDF Capacity versus Combi-wall width

Due to the very weak soils at the proposed site, stability considerations will limit the combi-wall crest elevation to 10 feet above Low Water Datum (LWD) despite the sheet pile being driven to 80 feet below LWD. To form the combi-walls, two parallel rows of wide flange 40x215 sections interspaced with PZC 13 steel sheet pile will be driven and tied together near the top using a wale system. The interior distance between the walls will be 60 feet and the area between the walls will be filled with a granular material and capped with a one-foot concrete paving. A schematic of the PZC™ 13 combi-wall system is presented in Insert 7[6].



Insert 7. Schematic of the PZC™ 13 Combi-wall System

In order to achieve a final fill elevation of 20 feet above LWD, as the CDF is filled, interior berms using the existing material will be constructed. Waves overtopping the combi-wall system will require that the berm be protected with stone. Two layers of 6 – 13 ton armor will overlay 1300-3000 pound underlayer stone, 3-12 inch bedding stone and a layer of geotextile fabric.

The potential interior volume of the CDF was determined by estimating the volume occupied by area delineated by the interior combi-wall line and subsequently subtracting the volume occupied by the stone structures. The outer combi-wall was located 25-feet from the existing Federal channel. The gross volume was determined by generating a digital terrain model (DTM) for the existing bottom, based upon surveys obtained in 2008 and the top elevation of the CDF at 20 feet LWD. Subtracting these two DTMs resulted in the gross volume within the CDF. Further subtraction of the volume occupied by the stone structures, loss of space by sloping the stone between +10 and +20 ft LWD and the minor addition of the berm above +20 ft LWD resulted in a net volume of 6,487,000 cubic yards. At an average fill rate of 330,000 cubic yards annually, the facility would reach capacity at 19.7 years as summarized in Table 2.

---

[6] LBFoster. 2009. Dimensions and Properties of PZC™ 13 Combi-wall System, www.fosterpiling.com

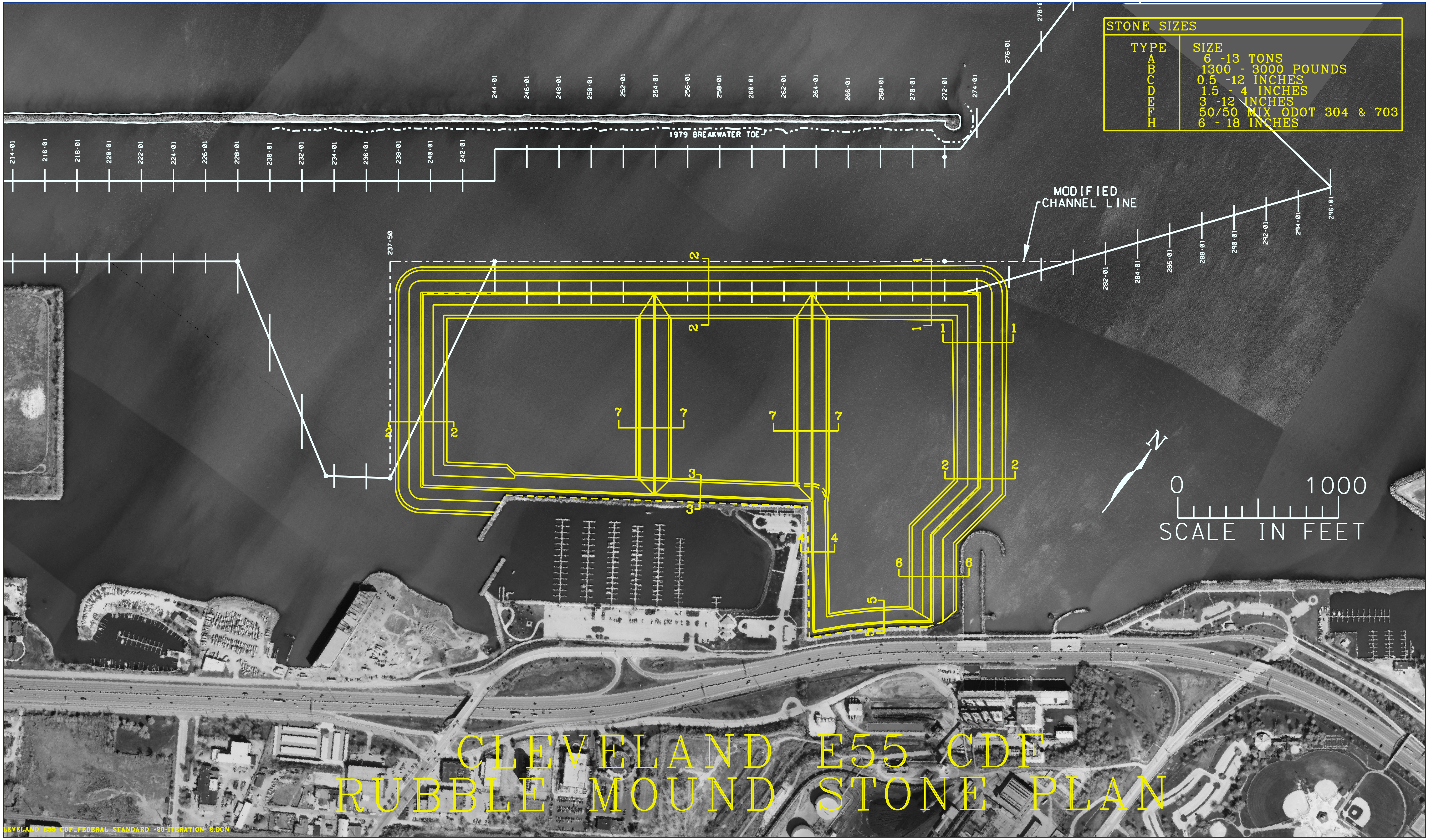
Table 2. Net Volume for Combi-wall System Alternative

Item	Volume - CY
Volume delineated by interior combi-wall line	7054504
Deductions of stone from	
Section 1-1	
South Leg	9502
West Leg	25139
North Leg	71323
East Leg	48765
Total Section 1-1	154728
Section 2-2	
Marina Leg	9770
Bikepath Leg	2088
Total Section 2-2	11858
Cross dikes	400469
TOTAL Deductions	567055
NET CDF Volume	**6,487,449**
Capacity (Years)	**19.7**

Figures 6-9 present the plan and typical cross-sections.

3. COST ESTIMATES

4. SELECTION OF ALTERNATIVE

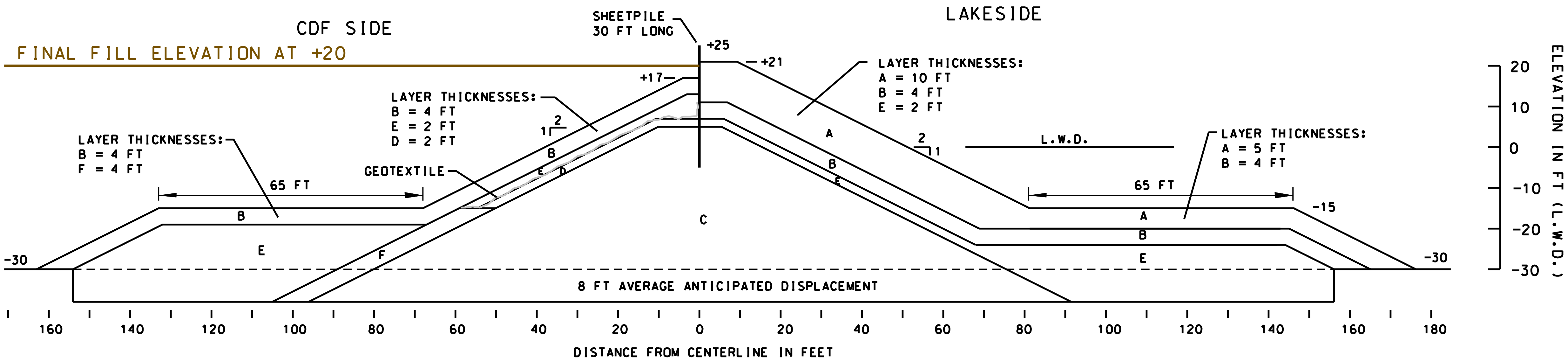


STONE SIZES

TYPE	SIZE
A	6 -13 TONS
B	1300 - 3000 POUNDS
C	0.5 -12 INCHES
D	1.5 - 4 INCHES
E	3 -12 INCHES
F	50/50 MIX ODOT 304 & 703
H	6 - 18 INCHES

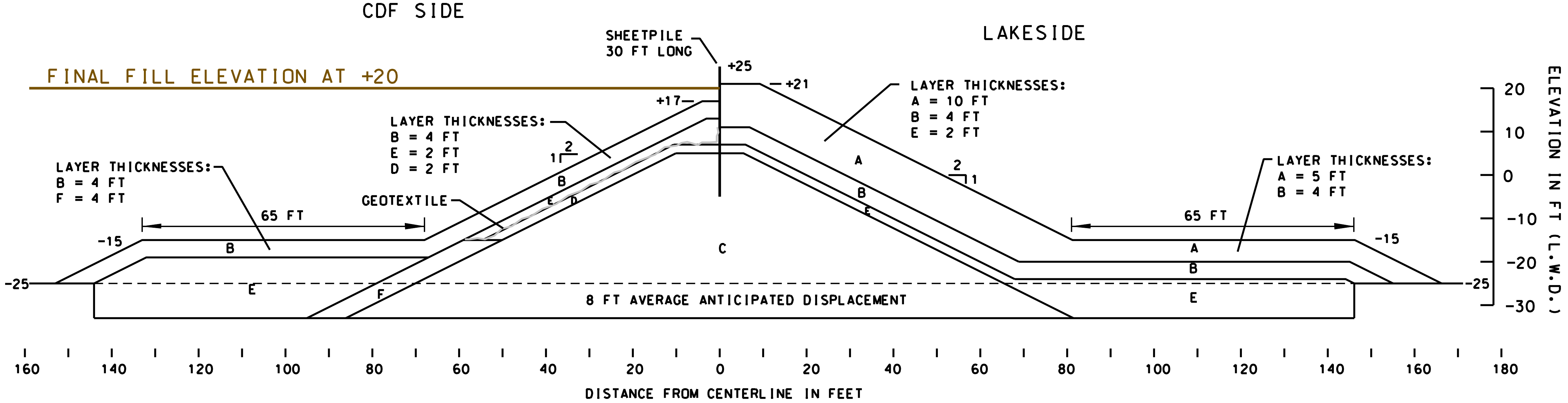
CLEVELAND E55 CDF
RUBBLE MOUND STONE PLAN

FIGURE 1



NORTH LEG: TYPICAL SECTION AT -30 FT LWD BOTTOM ELEVATION

SECTION 1-1



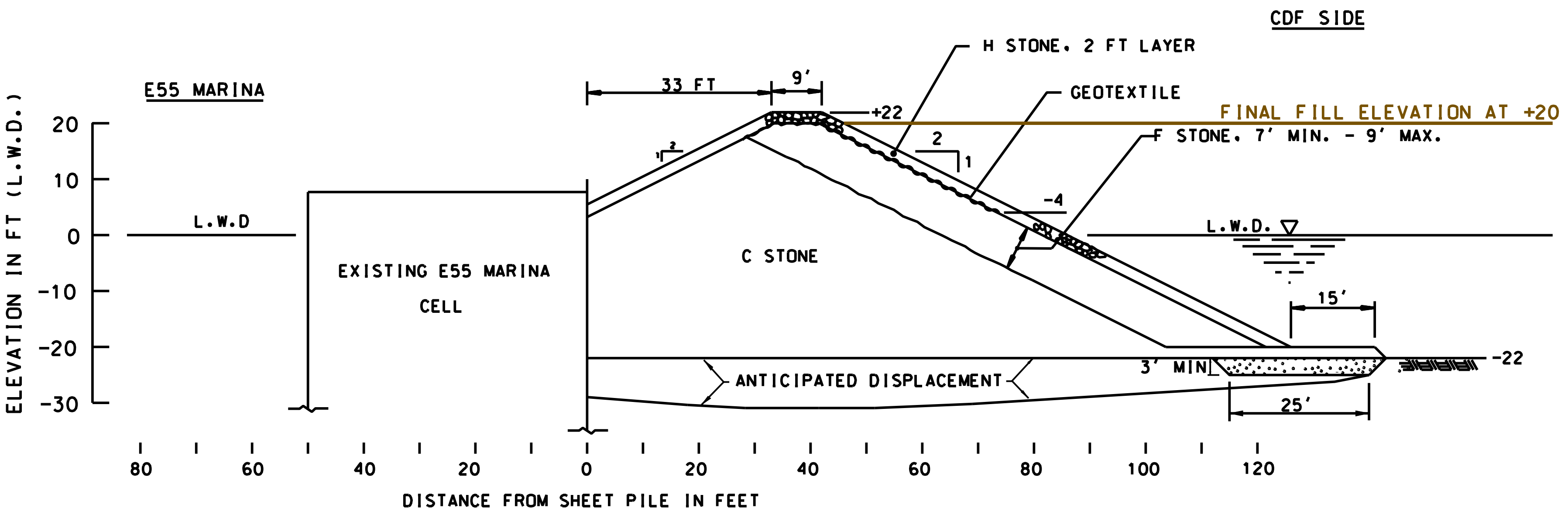
NORTH LEG: TYPICAL SECTION AT -25 FT LWD BOTTOM ELEVATION

SECTION 2-2

CLEV E55 CDF_FEDERAL STANDARD +20 SECTIONS.DGN

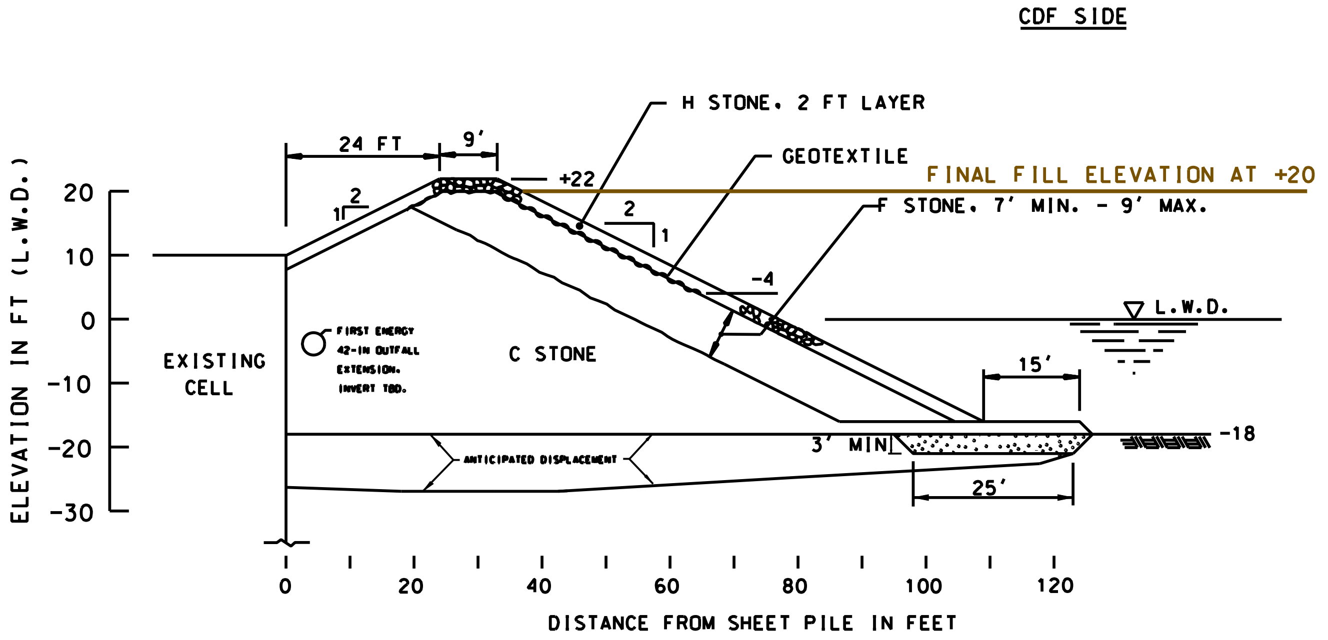
CLEVELAND EAST 55TH STREET CDF: RUBBLEMOUND ALTERNATIVE, SECTIONS 1-1 & 2-2

FIGURE 2



TYPICAL SECTION ALONG NORTH SIDE E55 MARINA AT -22 FT LWD BOTTOM ELEVATION

SECTION 3-3



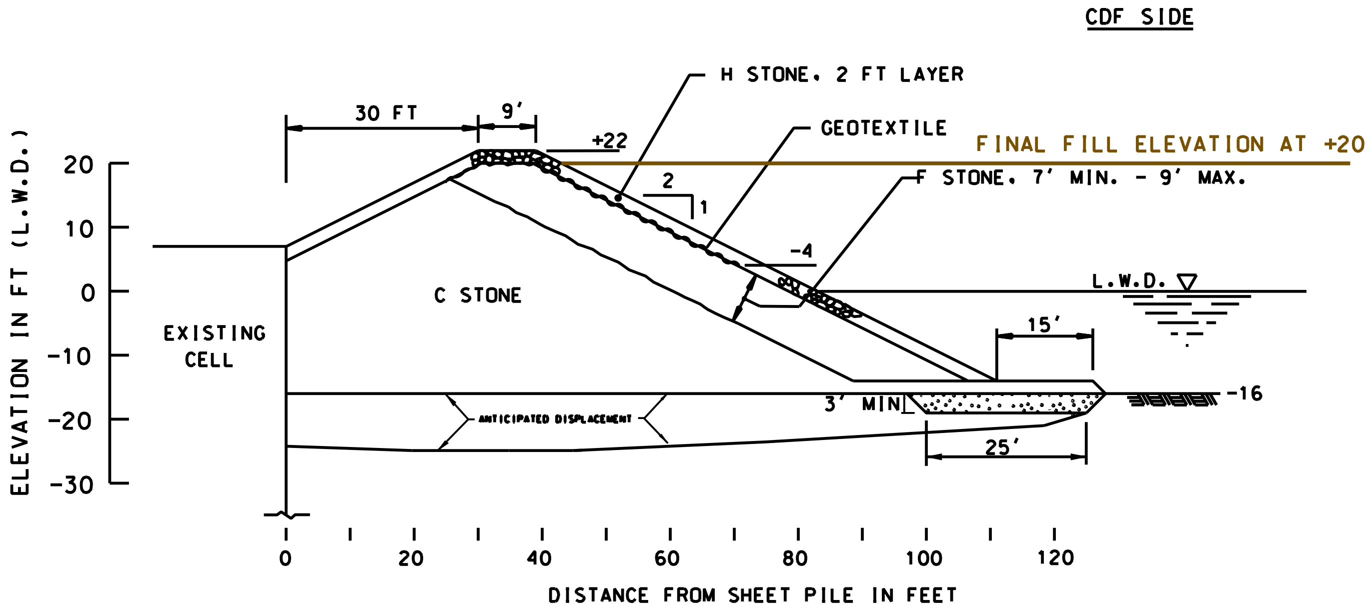
TYPICAL SECTION ALONG EAST SIDE E55 MARINA
AT -18 FT LWD BOTTOM ELEVATION

SECTION 4-4

CLEV E55 CDF_FEDERAL STANDARD +20 SECTIONS.DGN

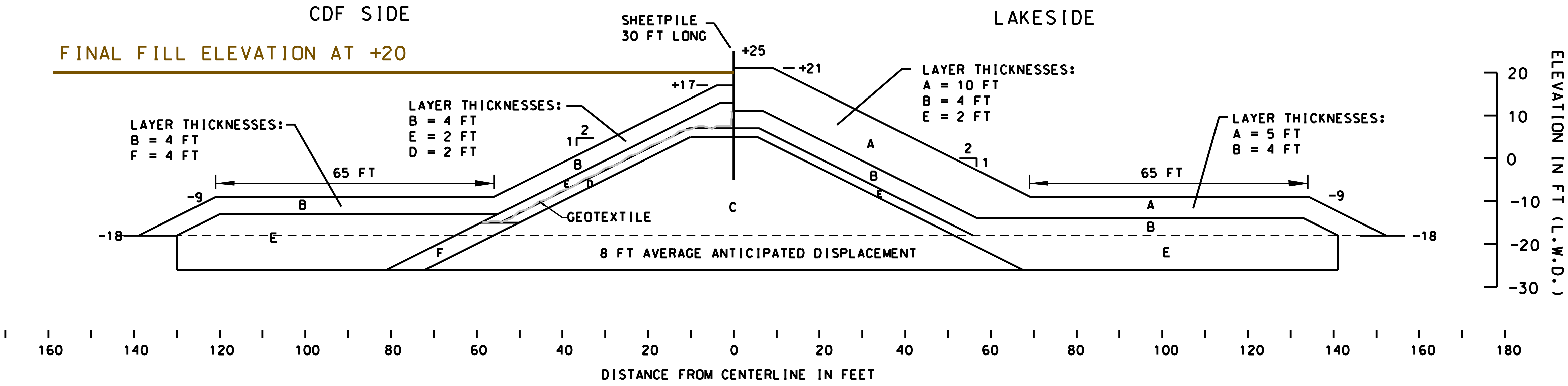
CLEVELAND EAST 55TH STREET CDF: RUBBLEMOUND ALTERNATIVE, SECTIONS 3-3 & 4-4

FIGURE 3



TYPICAL SECTION ALONG BIKEPATH
AT -16 FT LWD BOTTOM ELEVATION

SECTION 5-5



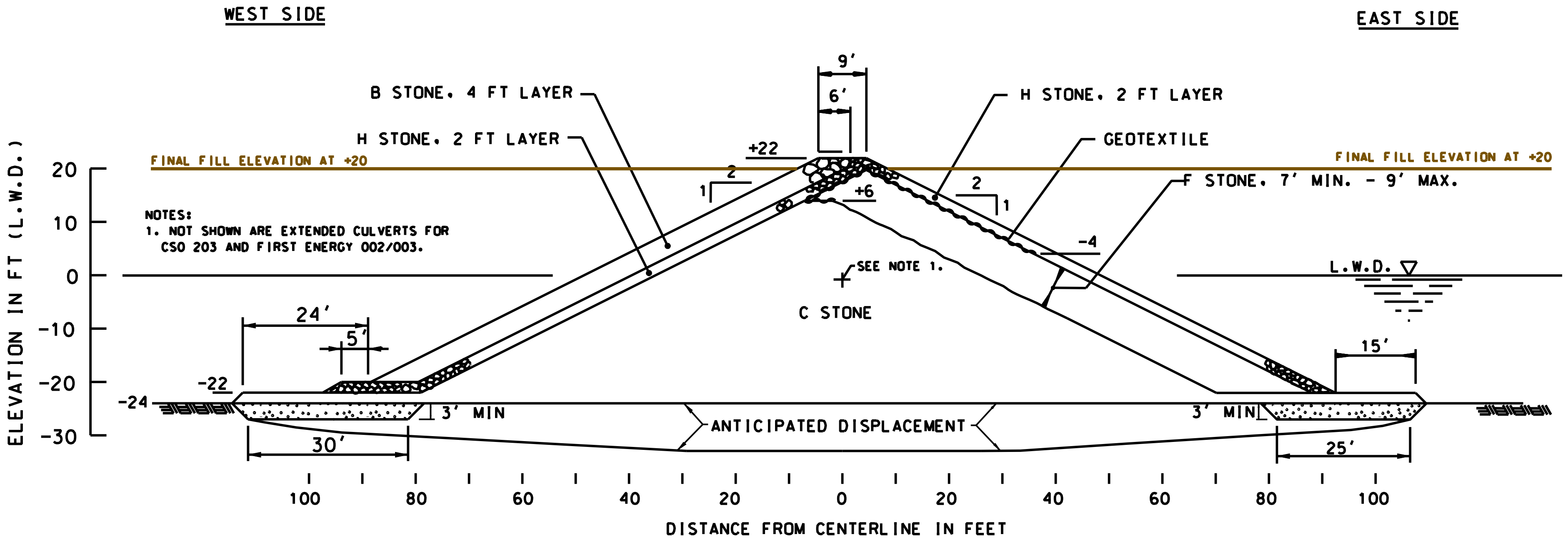
WEST LEG: TYPICAL SECTION AT -18 FT LWD BOTTOM ELEVATION

SECTION 6-6

CLEV E55 CDF_FEDERAL STANDARD +20 SECTIONS.DGN

CLEVELAND EAST 55TH STREET CDF: RUBBLEMOUND ALTERNATIVE, SECTIONS 5-5 & 6-6

FIGURE 4



NOTES:
1. NOT SHOWN ARE EXTENDED CULVERTS FOR CSO 203 AND FIRST ENERGY 002/003.

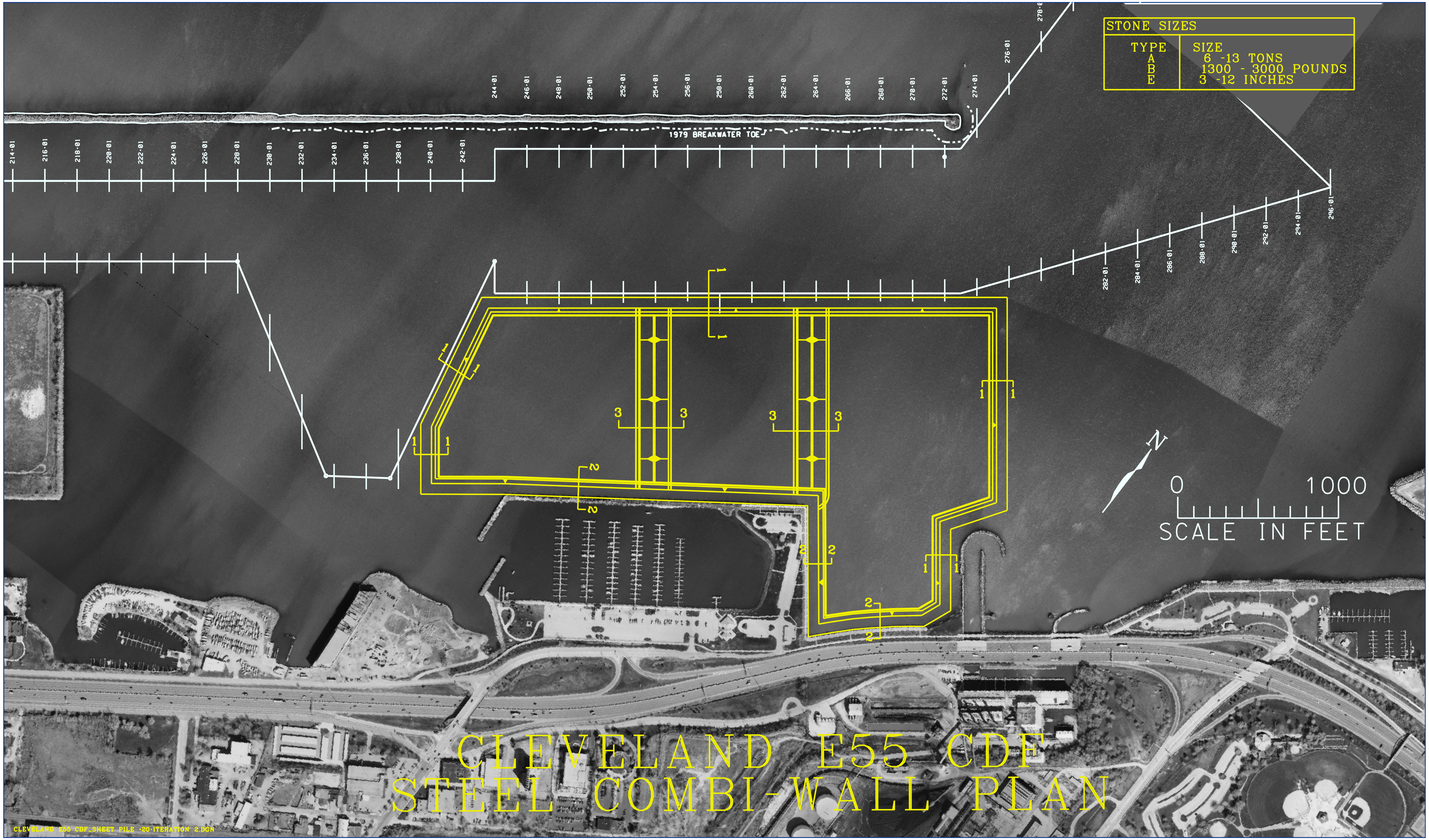
CROSS DIKES: TYPICAL SECTION AT -24 FT LWD BOTTOM ELEVATION

SECTION 7-7

CLEV E55 CDF_FEDERAL STANDARD +20 SECTIONS.DGN

CLEVELAND EAST 55TH STREET CDF: RUBBLEMOUND ALTERNATIVE, SECTION 7-7

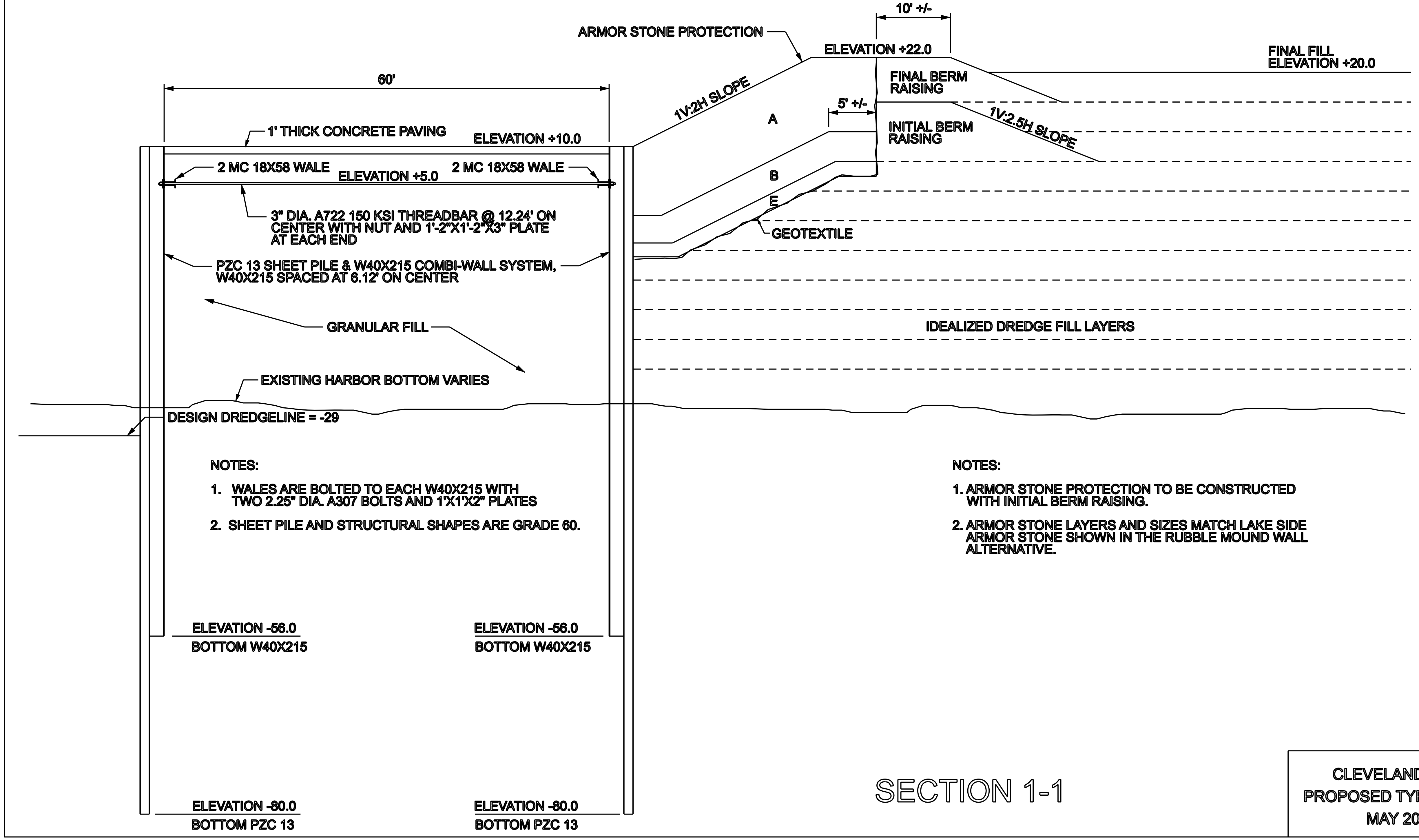
FIGURE 5



STONE SIZES	
TYPE	SIZE
A	6 -13 TONS
B	1300 - 3000 POUNDS
E	3 -12 INCHES

CLEVELAND E55 CDF
STEEL COMBI-WALL PLAN

FIGURE 6



NOTES:

1. WALES ARE BOLTED TO EACH W40X215 WITH TWO 2.25" DIA. A307 BOLTS AND 1'X1'X2" PLATES
2. SHEET PILE AND STRUCTURAL SHAPES ARE GRADE 60.

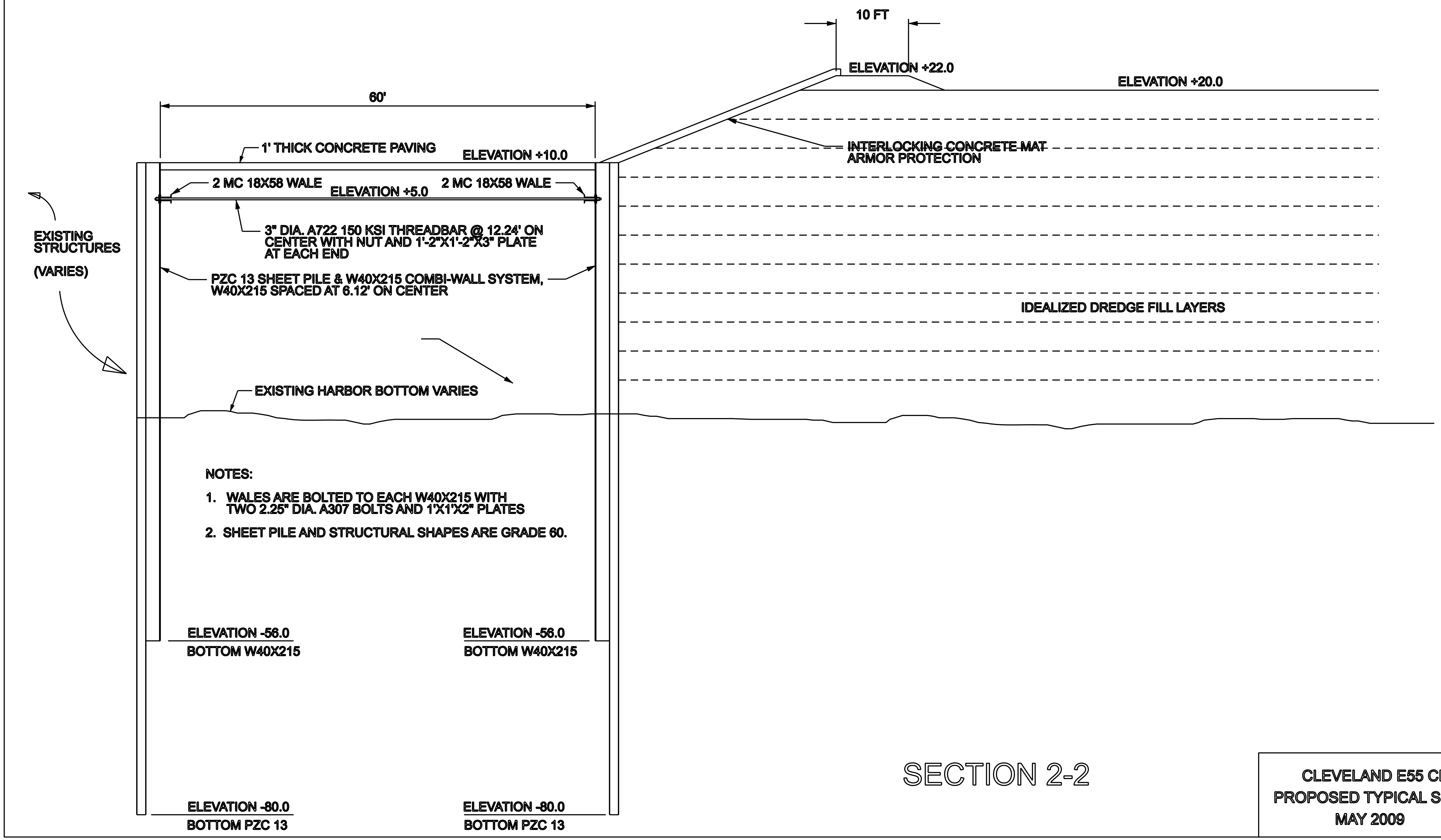
NOTES:

1. ARMOR STONE PROTECTION TO BE CONSTRUCTED WITH INITIAL BERM RAISING.
2. ARMOR STONE LAYERS AND SIZES MATCH LAKE SIDE ARMOR STONE SHOWN IN THE RUBBLE MOUND WALL ALTERNATIVE.

SECTION 1-1

CLEVELAND E55 CDF
PROPOSED TYPICAL SECTION
MAY 2009

FIGURE 7



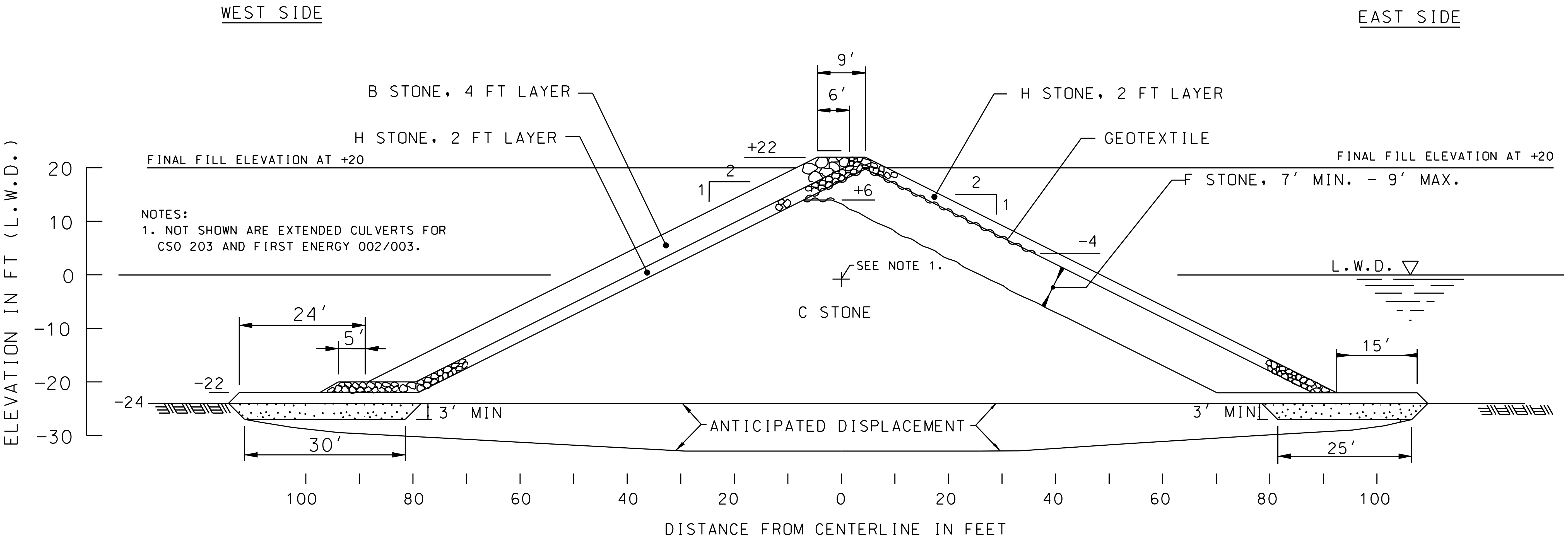
NOTES:

1. WALES ARE BOLTED TO EACH W40X215 WITH TWO 2.25" DIA. A307 BOLTS AND 1'X1'X2" PLATES
2. SHEET PILE AND STRUCTURAL SHAPES ARE GRADE 60.

SECTION 2-2

CLEVELAND E55 CDF
PROPOSED TYPICAL SECTION
MAY 2009

FIGURE 8



NOTES:
1. NOT SHOWN ARE EXTENDED CULVERTS FOR CSO 203 AND FIRST ENERGY 002/003.

CROSS DIKES: TYPICAL SECTION AT -24 FT LWD BOTTOM ELEVATION

SECTION 3-3

VERTICAL WALL SECTION.DGN

CLEVELAND E55 CDF
PROPOSED TYPICAL SECTION
3-3
MAY 2009

FIGURE 9

E55 CDF NEW Federal Alternative
Rubblemound stone alternative at E55 St location

Estimated by	JW
Designed by	M Mohr
Prepared by	James Wryk
Preparation Date	6/1/2009
Effective Date of Pricing	6/1/2009
Estimated Construction Time	Days

Date	Author	Note
7/30/2008	jw	Anticipate this project will be built in 3 phases. Therfeore each phase has a mob/demob action under the General Conditions.
7/30/2008	jw	Pricing used is from the 2006 estimates esculated to 4th Qtr 08 Price Levels. 10% contingencies added to the estimate across all work.. This estimate does not take into account any sewer relocations.
6/5/2009	jw	This estimate developed from a 21 May 2009 memo by Mike Mohr for a new layout for the proosed CDF at E55th street location. See memo that is within the folder containing this estimate.

Description	Quantity	UOM	ContractCost	Escalation	Contingency	ProjectCost
Project Cost Summary Report			**300,310,204**	**26,787,670**	**32,709,787**	**359,807,661**
Phase 1	**1.00**	**LS**	**133,718,719**	**11,927,710**	**14,564,643**	**160,211,071**
Phase 2	**1.00**	**LS**	**64,062,914**	**5,714,412**	**6,977,733**	**76,755,058**
Phase 3	**1.00**	**LS**	**102,528,571**	**9,145,549**	**11,167,412**	**122,841,532**

Description	Quantity	UOM	DirectCost	SubCMU	PrimeCMU	ContractCost
Contract Cost Summary Report			**249,738,647**	**0**	**50,571,557**	**300,310,204**
Phase 1	**1.00**	**LS**	**111,200,790**	**0**	**22,517,929**	**133,718,719**
General Conditions	**1.00**	**EA**	*1,006,480.44* **1,006,480**	**0**	**203,810**	*1,210,290.64* **1,210,291**
Temporary Office	**1.00**	**EA**	*47,015.46* **47,015**	**0**	**9,521**	*56,536.00* **56,536**
Submittals	**1.00**	**LS**	**32,102**	**0**	**6,501**	**38,602**
Mob and Demob	**1.00**	**LS**	**177,952**	**0**	**36,035**	**213,987**
Quality Control On-Site	**1.00**	**EA**	*749,411.32* **749,411**	**0**	**151,754**	*901,165.56* **901,166**
Type A	**245,700.00**	**TON**	*65.35* **16,056,742**	**0**	**3,251,457**	*78.58* **19,308,199**
Type B	**281,300.00**	**TON**	*59.83* **16,830,647**	**0**	**3,408,171**	*71.95* **20,238,817**
Type C	**1,450,000.00**	**TON**	*35.15* **50,969,484**	**0**	**10,321,215**	*42.27* **61,290,699**
Type D	**23,300.00**	**TON**	*17.40* **405,487**	**0**	**82,110**	*20.93* **487,598**
Type E	**446,100.00**	**TON**	*35.15* **15,681,025**	**0**	**3,175,375**	*42.27* **18,856,400**
Type F	**162,300.00**	**TON**	*17.30* **2,807,349**	**0**	**568,482**	*20.80* **3,375,831**
Type H	**59,400.00**	**TON**	*41.69* **2,476,419**	**0**	**501,470**	*50.13* **2,977,888**
Weir and Walkway	**1.00**	**EA**	*43,695.19* **43,695**	**0**	**8,848**	*52,543.38* **52,543**
Wier	**1.00**	**EA**	*40,098.76* **40,099**	**0**	**8,120**	*48,218.68* **48,219**
Walkway, Railing and Ladder	**1.00**	**EA**	*3,596.43* **3,596**	**0**	**728**	*4,324.70* **4,325**
Steel Sheet Pile Wall	**94,200.00**	**SF**	*14.28* **1,344,896**	**0**	**272,339**	*17.17* **1,617,234**

Description	Quantity	UOM	DirectCost	SubCMU	PrimeCMU	ContractCost
CZ67	**646.20**	**TON**	*2,081.24* **1,344,896**	**0**	**272,339**	*2,502.68* **1,617,234**
Geotextile	**50,100.00**	**SY**	*4.81* **241,066**	**0**	**48,815**	*5.79* **289,881**
Outfall Relocation	**2,670.00**	**LF**	*1,250.00* **3,337,500**	**0**	**675,837**	*1,503.12* **4,013,337**
Phase 2	**1.00**	**LS**	**53,274,865**	**0**	**10,788,049**	**64,062,914**
General Conditions	**1.00**	**EA**	*1,006,480.44* **1,006,480**	**0**	**203,810**	*1,210,290.64* **1,210,291**
Temporary Office	**1.00**	**EA**	*47,015.46* **47,015**	**0**	**9,521**	*56,536.00* **56,536**
Submittals	**1.00**	**LS**	**32,102**	**0**	**6,501**	**38,602**
Mob and Demob	**1.00**	**LS**	**177,952**	**0**	**36,035**	**213,987**
Quality Control On-Site	**1.00**	**EA**	*749,411.32* **749,411**	**0**	**151,754**	*901,165.56* **901,166**
Type A	**78,000.00**	**TON**	*65.35* **5,097,379**	**0**	**1,032,209**	*78.58* **6,129,587**
Type B	**109,300.00**	**TON**	*59.83* **6,539,601**	**0**	**1,324,256**	*71.95* **7,863,856**
Type C	**845,400.00**	**TON**	*35.15* **29,716,967**	**0**	**6,017,624**	*42.27* **35,734,591**
Type D	**7,400.00**	**TON**	*17.40* **128,781**	**0**	**26,078**	*20.93* **154,859**
Type E	**116,800.00**	**TON**	*35.15* **4,105,680**	**0**	**831,392**	*42.27* **4,937,071**
Type F	**114,800.00**	**TON**	*17.30* **1,985,728**	**0**	**402,106**	*20.80* **2,387,834**
Type H	**50,900.00**	**TON**	*41.69* **2,122,049**	**0**	**429,710**	*50.13* **2,551,759**
Weir and Walkway	**1.00**	**EA**	*43,695.19* **43,695**	**0**	**8,848**	*52,543.38* **52,543**
Wier	**1.00**	**EA**	*40,098.76* **40,099**	**0**	**8,120**	*48,218.68* **48,219**

Description	Quantity	UOM	DirectCost	SubCMU	PrimeCMU	ContractCost
Walkway, Railing and Ladder	**1.00**	**EA**	*3,596.43* **3,596**	**0**	**728**	*4,324.70* **4,325**
Steel Sheet Pile Wall	**29,800.00**	**SF**	*14.25* **424,572**	**0**	**85,975**	*17.13* **510,547**
CZ67	**204.00**	**TON**	*2,081.24* **424,572**	**0**	**85,975**	*2,502.68* **510,547**
Geotextile	**21,600.00**	**SY**	*4.81* **103,933**	**0**	**21,046**	*5.79* **124,979**
Outfall Relocation	**1,600.00**	**LF**	*1,250.00* **2,000,000**	**0**	**404,996**	*1,503.12* **2,404,996**
Phase 3	**1.00**	**LS**	**85,262,993**	**0**	**17,265,579**	**102,528,571**
General Conditions	**1.00**	**EA**	*1,006,480.44* **1,006,480**	**0**	**203,810**	*1,210,290.64* **1,210,291**
Temporary Office	**1.00**	**EA**	*47,015.46* **47,015**	**0**	**9,521**	*56,536.00* **56,536**
Submittals	**1.00**	**LS**	**32,102**	**0**	**6,501**	**38,602**
Mob and Demob	**1.00**	**LS**	**177,952**	**0**	**36,035**	**213,987**
Quality Control On-Site	**1.00**	**EA**	*749,411.32* **749,411**	**0**	**151,754**	*901,165.56* **901,166**
Type A	**259,800.00**	**TON**	*65.35* **16,978,191**	**0**	**3,438,048**	*78.58* **20,416,240**
Type B	**266,800.00**	**TON**	*59.83* **15,963,087**	**0**	**3,232,492**	*71.95* **19,195,579**
Type C	**956,300.00**	**TON**	*35.15* **33,615,254**	**0**	**6,807,019**	*42.27* **40,422,272**
Type D	**24,500.00**	**TON**	*17.40* **426,371**	**0**	**86,339**	*20.93* **512,710**
Type E	**389,200.00**	**TON**	*35.15* **13,680,913**	**0**	**2,770,356**	*42.27* **16,451,269**
Type F	**77,200.00**	**TON**	*17.30* **1,335,350**	**0**	**270,406**	*20.80* **1,605,756**
Type H	**15,500.00**	**TON**	*41.69* **646,203**	**0**	**130,855**	*50.13* **777,058**

Description	Quantity	UOM	DirectCost	SubCMU	PrimeCMU	ContractCost
			43,695.19			*52,543.38*
Weir and Walkway	**1.00**	**EA**	**43,695**	**0**	**8,848**	**52,543**
			40,098.76			*48,218.68*
Wier	**1.00**	**EA**	**40,099**	**0**	**8,120**	**48,219**
			3,596.43			*4,324.70*
Walkway, Railing and Ladder	**1.00**	**EA**	**3,596**	**0**	**728**	**4,325**
			14.27			*17.16*
Steel Sheet Pile Wall	**99,300.00**	**SF**	**1,417,323**	**0**	**287,005**	**1,704,328**
			2,081.24			*2,502.68*
CZ67	**681.00**	**TON**	**1,417,323**	**0**	**287,005**	**1,704,328**
			4.81			*5.79*
Geotextile	**31,200.00**	**SY**	**150,125**	**0**	**30,400**	**180,525**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	UserCost1	UserCost2	DirectMU	DirectCost
Project Direct Costs Report			**16,429,565**	**50,052,808**	**174,883,020**	**46,800**	**5,337,500**	**0**	**2,988,954**	**249,738,647**
Phase 1	**1.00**	**LS**	**7,162,724**	**22,149,714**	**77,231,337**	**15,600**	**3,337,500**	**0**	**1,303,916**	**111,200,790**
			440,486.88	*441,169.45*	*31,600.00*	*15,600.00*			*77,624.11*	*1,006,480.44*
General Conditions	**1.00**	**EA**	**440,487**	**441,169**	**31,600**	**15,600**	**0**	**0**	**77,624**	**1,006,480**
			14,526.72	*0.00*	*14,400.00*	*15,600.00*			*2,488.74*	*47,015.46*
Temporary Office	**1.00**	**EA**	**14,527**	**0**	**14,400**	**15,600**	**0**	**0**	**2,489**	**47,015**
			0.00	*0.00*	*300.00*	*0.00*	*0.00*	*0.00*	*0.00*	*300.00*
AF 015205000550 Office Trailer, furnished, rent per month, 50' x 12', excl. hookups	36.00	MO	0	0	10,800	0	0	0	0	10,800
			0.00	*0.00*	*0.00*	*400.00*	*0.00*	*0.00*	*0.00*	*400.00*
USR Utility Costs	36.00	MO	0	0	0	14,400	0	0	0	14,400
(Note: Include Electric, Phone, Fax and Supplies)										
USR Mob and Demob Office Trailer	1.00	LS	0	0	0	1,200	0	0	0	1,200
			403.52	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*	*69.13*	*572.65*
USR Janitorial	36.00	MO	14,527	0	3,600	0	0	0	2,489	20,615
Submittals	**1.00**	**LS**	**18,683**	**0**	**10,000**	**0**	**0**	**0**	**3,419**	**32,102**
USR Reproduction and Mail	1.00	LS	0	0	10,000	0	0	0	0	10,000
			622.76	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*113.97*	*736.73*
USR Initial Project Submittals	30.00	DAY	18,683	0	0	0	0	0	3,419	22,102
Mob and Demob	**1.00**	**LS**	**44,772**	**124,984**	**0**	**0**	**0**	**0**	**8,196**	**177,952**
(Note: Assume 3 days initial mob + 2 days demob year 1 + 2 days mob year 2 + 2 days demob year 2 + year 3 (11 days @ 12 hrs/day))										
			144.48	*575.49*	*0.00*	*0.00*	*0.00*	*0.00*	*26.20*	*746.17*
USR 1 tug + 4 barges + 1 Eng + 1 Oper + 2 Tug Workers	132.00	HR	19,071	75,964	0	0	0	0	3,459	98,494
			194.70	*371.36*	*0.00*	*0.00*	*0.00*	*0.00*	*35.89*	*601.95*
USR 1 Spud Barge + 1 Crane + 1 tug + 2 Oper + 2 Deck	132.00	HR	25,700	49,020	0	0	0	0	4,737	79,457
			362,505.60	*316,185.72*	*7,200.00*	*0.00*			*63,520.00*	*749,411.32*
Quality Control On-Site	**1.00**	**EA**	**362,506**	**316,186**	**7,200**	**0**	**0**	**0**	**63,520**	**749,411**
			10,069.60	*8,782.94*	*200.00*	*0.00*	*0.00*	*0.00*	*1,764.44*	*20,816.98*
USR Quality Control	36.00	MO	362,506	316,186	7,200	0	0	0	63,520	749,411
			3.08	*9.21*	*52.50*	*0.00*			*0.56*	*65.35*
Type A	**245,700.00**	**TON**	**756,838**	**2,262,314**	**12,899,250**	**0**	**0**	**0**	**138,340**	**16,056,742**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	UserCost1	UserCost2	DirectMU	DirectCost
			1.48	*2.81*	*52.50*	*0.00*	*0.00*	*0.00*	*0.27*	*57.06*
USR Type A Armor Stone (5 ton to 10 ton)	245,700.00	TON	362,408	691,236	12,899,250	0	0	0	66,804	14,019,697
			1.61	*6.39*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.29*
USR Haul from Sandusky	245,700.00	TON	394,430	1,571,078	0	0	0	0	71,536	2,037,045
(Note: 2400 tons per cycle, 24 hrs per cycle)										
			2.75	*8.58*	*48.00*	*0.00*			*0.50*	*59.83*
Type B	**281,300.00**	**TON**	**773,752**	**2,413,207**	**13,502,400**	**0**	**0**	**0**	**141,288**	**16,830,647**
			1.15	*2.18*	*48.00*	*0.00*	*0.00*	*0.00*	*0.21*	*51.54*
USR Type B Stone (600 lb to 2000 lb) Placed for CDF	281,300.00	TON	322,171	614,491	13,502,400	0	0	0	59,387	14,498,450
			1.61	*6.39*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.29*
USR Haul from Sandusky	281,300.00	TON	451,580	1,798,715	0	0	0	0	81,901	2,332,197
(Note: 2400 tons per cycle, 24 hrs per cycle)										
			2.37	*7.85*	*24.50*	*0.00*			*0.43*	*35.15*
Type C	**1,450,000.00**	**TON**	**3,434,851**	**11,383,383**	**35,525,000**	**0**	**0**	**0**	**626,250**	**50,969,484**
			0.76	*1.46*	*24.50*	*0.00*	*0.00*	*0.00*	*0.14*	*26.86*
USR Type C Stone	1,450,000.00	TON	1,107,118	2,111,654	35,525,000	0	0	0	204,080	38,947,851
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)										
			1.61	*6.39*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.29*
USR Haul from Sandusky	1,450,000.00	TON	2,327,733	9,271,729	0	0	0	0	422,171	12,021,633
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.29	*7.70*	*7.00*	*0.00*			*0.42*	*17.40*
Type D	**23,300.00**	**TON**	**53,322**	**179,347**	**163,100**	**0**	**0**	**0**	**9,718**	**405,487**
			0.68	*1.30*	*7.00*	*0.00*	*0.00*	*0.00*	*0.13*	*9.11*
USR Type D Stone	23,300.00	TON	15,918	30,360	163,100	0	0	0	2,934	212,312
(Note: (4" Minus) ODOT 703.19A Crushed Ag clev e brkwtr 30/ton)										
			1.61	*6.39*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.29*
USR Haul from Sandusky	23,300.00	TON	37,404	148,987	0	0	0	0	6,784	193,175
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.37	*7.85*	*24.50*	*0.00*			*0.43*	*35.15*
Type E	**446,100.00**	**TON**	**1,056,750**	**3,502,157**	**10,929,450**	**0**	**0**	**0**	**192,669**	**15,681,025**
			0.76	*1.46*	*24.50*	*0.00*	*0.00*	*0.00*	*0.14*	*26.86*
USR Type C and E Stone	446,100.00	TON	340,610	649,661	10,929,450	0	0	0	62,786	11,982,508

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	UserCost1	UserCost2	DirectMU	DirectCost
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)										
			1.61	*6.39*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.29*
USR Haul from Sandusky	446,100.00	TON	716,139	2,852,495	0	0	0	0	129,883	3,698,517
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.25	*7.63*	*7.00*	*0.00*			*0.41*	*17.30*
Type F	**162,300.00**	**TON**	**365,878**	**1,238,700**	**1,136,100**	**0**	**0**	**0**	**66,670**	**2,807,349**
			0.65	*1.24*	*7.00*	*0.00*	*0.00*	*0.00*	*0.12*	*9.01*
USR Type F Stone	162,300.00	TON	105,333	200,906	1,136,100	0	0	0	19,416	1,461,755
(Note: (3/4" to 1") ODOT 703.01 Size No. 68 clev e brkwtr 20/ton)										
			1.61	*6.39*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.29*
USR Haul from Sandusky	162,300.00	TON	260,546	1,037,794	0	0	0	0	47,254	1,345,594
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.51	*8.12*	*30.60*	*0.00*			*0.46*	*41.69*
Type H	**59,400.00**	**TON**	**149,148**	**482,420**	**1,817,640**	**0**	**0**	**0**	**27,210**	**2,476,419**
			0.91	*1.73*	*30.60*	*0.00*	*0.00*	*0.00*	*0.17*	*33.40*
USR Type H Stone	59,400.00	TON	53,792	102,599	1,817,640	0	0	0	9,916	1,983,946
(Note: (6" - 18") ODOT 703.19B Type C)										
			1.61	*6.39*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.29*
USR Haul from Sandusky	59,400.00	TON	95,357	379,821	0	0	0	0	17,294	492,472
(Note: 2400 tons per trip, 24 hrs per trip)										
			15,454.76	*21,954.08*	*3,516.80*	*0.00*			*2,769.56*	*43,695.19*
Weir and Walkway	**1.00**	**EA**	**15,455**	**21,954**	**3,517**	**0**	**0**	**0**	**2,770**	**43,695**
(Note: Quantities obtained from Dike 10b IGE dated June 1996)										
			14,260.32	*21,810.47*	*1,420.50*	*0.00*			*2,607.48*	*40,098.76*
Wier	**1.00**	**EA**	**14,260**	**21,810**	**1,421**	**0**	**0**	**0**	**2,607**	**40,099**
			15.84	*24.23*	*0.70*	*0.00*	*0.00*	*0.00*	*2.90*	*43.68*
MIL 031104300150 C.I.P. concrete forms, footing, continuous wall, plywood, 4 use, includes erecting, bracing, stripping and cleaning	300.00	SFC	4,753	7,270	210	0	0	0	869	13,103
			2,376.72	*3,635.08*	*541.50*	*0.00*	*0.00*	*0.00*	*434.58*	*6,987.88*
MIL 032106000700 Reinforcing steel, in place, walls, #3 to #7, A615, grade 60	1.00	TON	2,377	3,635	542	0	0	0	435	6,988
			396.12	*605.85*	*0.00*	*0.00*	*0.00*	*0.00*	*72.43*	*1,074.40*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	UserCost1	UserCost2	DirectMU	DirectCost
USR 033107005400 Structural concrete, placing, walls, with crane and bucket, 15" thick, includes vibrating, excludes material	6.00	CY	2,377	3,635	0	0	0	0	435	6,446
			0.00	*0.00*	*110.00*	*0.00*	*0.00*	*0.00*	*0.00*	*110.00*
MIL 033102200300 Structural concrete, ready mix, normal weight, 4000 PSI, includes material only	6.00	CY	0	0	660	0	0	0	0	660
			15.84	*24.23*	*0.03*	*0.00*	*0.00*	*0.00*	*2.90*	*43.01*
MIL 033503500010 Concrete finishing, walls, includes breaking ties and patching voids	300.00	SF	4,753	7,270	9	0	0	0	869	12,902
			1,194.44	*143.61*	*2,096.30*	*0.00*			*162.08*	*3,596.43*
Walkway, Railing and Ladder	**1.00**	**EA**	**1,194**	**144**	**2,096**	**0**	**0**	**0**	**162**	**3,596**
			7.40	*0.75*	*13.92*	*0.00*	*0.00*	*0.00*	*1.00*	*23.07*
RSM 055207000020 Railing, pipe, aluminum, satin finish, 2 rails, 1-1/4" dia	20.00	LF	148	15	278	0	0	0	20	461
			1.97	*0.20*	*8.86*	*0.00*	*0.00*	*0.00*	*0.27*	*11.30*
MIL 055303400694 Floor grating, steel, galvanized, 1-1/4" x 3/16" bearing bars @ 15/16" O.C., cross bars @ 4" O.C., 9.1 #/S.F., up to 300 S.F.	100.00	SF	197	20	886	0	0	0	27	1,130
			24.70	*3.65*	*4.40*	*0.00*	*0.00*	*0.00*	*3.35*	*36.10*
MIL 051204400672 Channel framing, structural steel, field fabricated, C8x11.5, incl cutting & welding	20.00	LF	494	73	88	0	0	0	67	722
			23.68	*2.39*	*56.26*	*0.00*	*0.00*	*0.00*	*3.21*	*85.54*
MIL 055145000020 Ladder, steel, 20" W, bolted to concrete, incl cage	15.00	VLF	355	36	844	0	0	0	48	1,283
			0.61	*1.20*	*12.35*	*0.00*			*0.11*	*14.28*
Steel Sheet Pile Wall	**94,200.00**	**SF**	**57,717**	**113,432**	**1,163,160**	**0**	**0**	**0**	**10,588**	**1,344,896**
			89.32	*175.54*	*1,800.00*	*0.00*			*16.38*	*2,081.24*
CZ67	**646.20**	**TON**	**57,717**	**113,432**	**1,163,160**	**0**	**0**	**0**	**10,588**	**1,344,896**
			89.32	*175.54*	*1,800.00*	*0.00*	*0.00*	*0.00*	*16.38*	*2,081.24*
USR Marine Sheet piling, steel, 38 psf, 40' excavation, left in place, excludes wales	646.20	TON	57,717	113,432	1,163,160	0	0	0	10,588	1,344,896

(Note: Modified for Marine Plant)

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	UserCost1	UserCost2	DirectMU	DirectCost
			1.17	*2.23*	*1.20*	*0.00*			*0.22*	*4.81*
Geotextile	**50,100.00**	**SY**	**58,527**	**111,631**	**60,120**	**0**	**0**	**0**	**10,788**	**241,066**
			0.97	*1.86*	*1.00*	*0.00*	*0.00*	*0.00*	*0.18*	*4.01*
USR Geotextile	60,120.00	SY	58,527	111,631	60,120	0	0	0	10,788	241,066
(Note: 50 ft x 15 ft / 9 sf/sy = 83 sy Section. Say 1/2 hr to place a section. 83 sy x 2 = 164 sy hr. Use 200 sy/hr. Includes overlap)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*1,250.00*
Outfall Relocation	**2,670.00**	**LF**	**0**	**0**	**0**	**0**	**3,337,500**	**0**	**0**	**3,337,500**
(Note: Relocated First Energy Outfall 002 & 003. Outfalls to be relocated through the west arm of the first phase of the CDF. No sizes given. Assume the East 20 th street design from Cleveland 10b CDF.)										
			0.00	*0.00*	*0.00*	*0.00*	*1,250.00*	*0.00*	*0.00*	*1,250.00*
USR Outfall Relocation	2,670.00	LF	0	0	0	0	3,337,500	0	0	3,337,500
(Note: From Cleveland CDF 10B E20th Street outfall -171" x 110" Corr Steel Pipe Arch. Low Bidders unit Cost updated by ENR to current date.)										
Phase 2	**1.00**	**LS**	**3,723,163**	**11,103,290**	**35,756,477**	**15,600**	**2,000,000**	**0**	**676,335**	**53,274,865**
			440,486.88	*441,169.45*	*31,600.00*	*15,600.00*			*77,624.11*	*1,006,480.44*
General Conditions	**1.00**	**EA**	**440,487**	**441,169**	**31,600**	**15,600**	**0**	**0**	**77,624**	**1,006,480**
			14,526.72	*0.00*	*14,400.00*	*15,600.00*			*2,488.74*	*47,015.46*
Temporary Office	**1.00**	**EA**	**14,527**	**0**	**14,400**	**15,600**	**0**	**0**	**2,489**	**47,015**
			0.00	*0.00*	*300.00*	*0.00*	*0.00*	*0.00*	*0.00*	*300.00*
AF 015205000550 Office Trailer, furnished, rent per month, 50' x 12', excl. hookups	36.00	MO	0	0	10,800	0	0	0	0	10,800
			0.00	*0.00*	*0.00*	*400.00*	*0.00*	*0.00*	*0.00*	*400.00*
USR Utility Costs	36.00	MO	0	0	0	14,400	0	0	0	14,400
(Note: Include Electric, Phone, Fax and Supplies)										
USR Mob and Demob Office Trailer	1.00	LS	0	0	0	1,200	0	0	0	1,200
			403.52	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*	*69.13*	*572.65*
USR Janitorial	36.00	MO	14,527	0	3,600	0	0	0	2,489	20,615
Submittals	**1.00**	**LS**	**18,683**	**0**	**10,000**	**0**	**0**	**0**	**3,419**	**32,102**
USR Reproduction and Mail	1.00	LS	0	0	10,000	0	0	0	0	10,000
			622.76	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*113.97*	*736.73*
USR Initial Project Submittals	30.00	DAY	18,683	0	0	0	0	0	3,419	22,102
Mob and Demob	**1.00**	**LS**	**44,772**	**124,984**	**0**	**0**	**0**	**0**	**8,196**	**177,952**
(Note: Assume 3 days initial mob + 2 days demob year 1 + 2 days mob year 2 + 2 days demob year 2 + year 3 (11 days @ 12 hrs/day))										

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	UserCost1	UserCost2	DirectMU	DirectCost
			144.48	*575.49*	*0.00*	*0.00*	*0.00*	*0.00*	*26.20*	*746.17*
USR 1 tug + 4 barges + 1 Eng + 1 Oper + 2 Tug Workers	132.00	HR	19,071	75,964	0	0	0	0	3,459	98,494
			194.70	*371.36*	*0.00*	*0.00*	*0.00*	*0.00*	*35.89*	*601.95*
USR 1 Spud Barge + 1 Crane + 1 tug + 2 Oper + 2 Deck	132.00	HR	25,700	49,020	0	0	0	0	4,737	79,457
			362,505.60	*316,185.72*	*7,200.00*	*0.00*			*63,520.00*	*749,411.32*
Quality Control On-Site	**1.00**	**EA**	**362,506**	**316,186**	**7,200**	**0**	**0**	**0**	**63,520**	**749,411**
			10,069.60	*8,782.94*	*200.00*	*0.00*	*0.00*	*0.00*	*1,764.44*	*20,816.98*
USR Quality Control	36.00	MO	362,506	316,186	7,200	0	0	0	63,520	749,411
			3.08	*9.21*	*52.50*	*0.00*			*0.56*	*65.35*
Type A	**78,000.00**	**TON**	**240,266**	**718,195**	**4,095,000**	**0**	**0**	**0**	**43,918**	**5,097,379**
			1.48	*2.81*	*52.50*	*0.00*	*0.00*	*0.00*	*0.27*	*57.06*
USR Type A Armor Stone (5 ton to 10 ton)	78,000.00	TON	115,050	219,440	4,095,000	0	0	0	21,208	4,450,698
			1.61	*6.39*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.29*
USR Haul from Sandusky	78,000.00	TON	125,216	498,755	0	0	0	0	22,710	646,681
(Note: 2400 tons per cycle, 24 hrs per cycle)										
			2.75	*8.58*	*48.00*	*0.00*			*0.50*	*59.83*
Type B	**109,300.00**	**TON**	**300,644**	**937,659**	**5,246,400**	**0**	**0**	**0**	**54,898**	**6,539,601**
			1.15	*2.18*	*48.00*	*0.00*	*0.00*	*0.00*	*0.21*	*51.54*
USR Type B Stone (600 lb to 2000 lb) Placed for CDF	109,300.00	TON	125,181	238,763	5,246,400	0	0	0	23,075	5,633,418
			1.61	*6.39*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.29*
USR Haul from Sandusky	109,300.00	TON	175,463	698,897	0	0	0	0	31,823	906,182
(Note: 2400 tons per cycle, 24 hrs per cycle)										
			2.37	*7.85*	*24.50*	*0.00*			*0.43*	*35.15*
Type C	**845,400.00**	**TON**	**2,002,637**	**6,636,905**	**20,712,300**	**0**	**0**	**0**	**365,126**	**29,716,967**
			0.76	*1.46*	*24.50*	*0.00*	*0.00*	*0.00*	*0.14*	*26.86*
USR Type C Stone	845,400.00	TON	645,488	1,231,167	20,712,300	0	0	0	118,985	22,707,940
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)										
			1.61	*6.39*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.29*
USR Haul from Sandusky	845,400.00	TON	1,357,149	5,405,738	0	0	0	0	246,140	7,009,026
(Note: 2400 tons per trip, 24 hrs per trip)										

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	UserCost1	UserCost2	DirectMU	DirectCost
			2.29	*7.70*	*7.00*	*0.00*			*0.42*	*17.40*
Type D	**7,400.00**	**TON**	**16,935**	**56,960**	**51,800**	**0**	**0**	**0**	**3,086**	**128,781**
			0.68	*1.30*	*7.00*	*0.00*	*0.00*	*0.00*	*0.13*	*9.11*
USR Type D Stone	7,400.00	TON	5,055	9,642	51,800	0	0	0	932	67,430
(Note: (4" Minus) ODOT 703.19A Crushed Ag clev e brkwtr 30/ton)										
			1.61	*6.39*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.29*
USR Haul from Sandusky	7,400.00	TON	11,879	47,318	0	0	0	0	2,155	61,352
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.37	*7.85*	*24.50*	*0.00*			*0.43*	*35.15*
Type E	**116,800.00**	**TON**	**276,683**	**916,951**	**2,861,600**	**0**	**0**	**0**	**50,446**	**4,105,680**
			0.76	*1.46*	*24.50*	*0.00*	*0.00*	*0.00*	*0.14*	*26.86*
USR Type C and E Stone	116,800.00	TON	89,180	170,097	2,861,600	0	0	0	16,439	3,137,317
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)										
			1.61	*6.39*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.29*
USR Haul from Sandusky	116,800.00	TON	187,503	746,854	0	0	0	0	34,007	968,363
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.25	*7.63*	*7.00*	*0.00*			*0.41*	*17.30*
Type F	**114,800.00**	**TON**	**258,797**	**876,172**	**803,600**	**0**	**0**	**0**	**47,158**	**1,985,728**
			0.65	*1.24*	*7.00*	*0.00*	*0.00*	*0.00*	*0.12*	*9.01*
USR Type F Stone	114,800.00	TON	74,505	142,107	803,600	0	0	0	13,734	1,033,946
(Note: (3/4" to 1") ODOT 703.01 Size No. 68 clev e brkwtr 20/ton)										
			1.61	*6.39*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.29*
USR Haul from Sandusky	114,800.00	TON	184,292	734,065	0	0	0	0	33,424	951,782
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.51	*8.12*	*30.60*	*0.00*			*0.46*	*41.69*
Type H	**50,900.00**	**TON**	**127,806**	**413,387**	**1,557,540**	**0**	**0**	**0**	**23,316**	**2,122,049**
			0.91	*1.73*	*30.60*	*0.00*	*0.00*	*0.00*	*0.17*	*33.40*
USR Type H Stone	50,900.00	TON	46,094	87,917	1,557,540	0	0	0	8,497	1,700,048
(Note: (6" - 18") ODOT 703.19B Type C)										
			1.61	*6.39*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.29*
USR Haul from Sandusky	50,900.00	TON	81,711	325,470	0	0	0	0	14,820	422,001
(Note: 2400 tons per trip, 24 hrs per trip)										
			15,454.76	*21,954.08*	*3,516.80*	*0.00*			*2,769.56*	*43,695.19*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	UserCost1	UserCost2	DirectMU	DirectCost
Weir and Walkway	**1.00**	**EA**	**15,455**	**21,954**	**3,517**	**0**	**0**	**0**	**2,770**	**43,695**
(Note: Quantities obtained from Dike 10b IGE dated June 1996)										
			14,260.32	*21,810.47*	*1,420.50*	*0.00*			*2,607.48*	*40,098.76*
Wier	**1.00**	**EA**	**14,260**	**21,810**	**1,421**	**0**	**0**	**0**	**2,607**	**40,099**
			15.84	*24.23*	*0.70*	*0.00*	*0.00*	*0.00*	*2.90*	*43.68*
MIL 031104300150 C.I.P. concrete forms, footing, continuous wall, plywood, 4 use, includes erecting, bracing, stripping and cleaning	300.00	SFC	4,753	7,270	210	0	0	0	869	13,103
			2,376.72	*3,635.08*	*541.50*	*0.00*	*0.00*	*0.00*	*434.58*	*6,987.88*
MIL 032106000700 Reinforcing steel, in place, walls, #3 to #7, A615, grade 60	1.00	TON	2,377	3,635	542	0	0	0	435	6,988
			396.12	*605.85*	*0.00*	*0.00*	*0.00*	*0.00*	*72.43*	*1,074.40*
USR 033107005400 Structural concrete, placing, walls, with crane and bucket, 15" thick, includes vibrating, excludes material	6.00	CY	2,377	3,635	0	0	0	0	435	6,446
			0.00	*0.00*	*110.00*	*0.00*	*0.00*	*0.00*	*0.00*	*110.00*
MIL 033102200300 Structural concrete, ready mix, normal weight, 4000 PSI, includes material only	6.00	CY	0	0	660	0	0	0	0	660
			15.84	*24.23*	*0.03*	*0.00*	*0.00*	*0.00*	*2.90*	*43.01*
MIL 033503500010 Concrete finishing, walls, includes breaking ties and patching voids	300.00	SF	4,753	7,270	9	0	0	0	869	12,902
			1,194.44	*143.61*	*2,096.30*	*0.00*			*162.08*	*3,596.43*
Walkway, Railing and Ladder	**1.00**	**EA**	**1,194**	**144**	**2,096**	**0**	**0**	**0**	**162**	**3,596**
			7.40	*0.75*	*13.92*	*0.00*	*0.00*	*0.00*	*1.00*	*23.07*
RSM 055207000020 Railing, pipe, aluminum, satin finish, 2 rails, 1-1/4" dia	20.00	LF	148	15	278	0	0	0	20	461
			1.97	*0.20*	*8.86*	*0.00*	*0.00*	*0.00*	*0.27*	*11.30*
MIL 055303400694 Floor grating, steel, galvanized, 1-1/4" x 3/16" bearing bars @ 15/16" O.C., cross bars @ 4" O.C., 9.1 #/S.F., up to 300 S.F.	100.00	SF	197	20	886	0	0	0	27	1,130
			24.70	*3.65*	*4.40*	*0.00*	*0.00*	*0.00*	*3.35*	*36.10*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	UserCost1	UserCost2	DirectMU	DirectCost
MIL 051204400672 Channel framing, structural steel, field fabricated, C8x11.5, incl cutting & welding	20.00	LF	494	73	88	0	0	0	67	722
			23.68	*2.39*	*56.26*	*0.00*	*0.00*	*0.00*	*3.21*	*85.54*
MIL 055145000020 Ladder, steel, 20" W, bolted to concrete, incl cage	15.00	VLF	355	36	844	0	0	0	48	1,283
			0.61	*1.20*	*12.32*	*0.00*			*0.11*	*14.25*
Steel Sheet Pile Wall	**29,800.00**	**SF**	**18,221**	**35,809**	**367,200**	**0**	**0**	**0**	**3,342**	**424,572**
			89.32	*175.54*	*1,800.00*	*0.00*			*16.38*	*2,081.24*
CZ67	**204.00**	**TON**	**18,221**	**35,809**	**367,200**	**0**	**0**	**0**	**3,342**	**424,572**
			89.32	*175.54*	*1,800.00*	*0.00*	*0.00*	*0.00*	*16.38*	*2,081.24*
USR Marine Sheet piling, steel, 38 psf, 40' excavation, left in place, excludes wales	204.00	TON	18,221	35,809	367,200	0	0	0	3,342	424,572
(Note: Modified for Marine Plant)										
			1.17	*2.23*	*1.20*	*0.00*			*0.22*	*4.81*
Geotextile	**21,600.00**	**SY**	**25,233**	**48,128**	**25,920**	**0**	**0**	**0**	**4,651**	**103,933**
			0.97	*1.86*	*1.00*	*0.00*	*0.00*	*0.00*	*0.18*	*4.01*
USR Geotextile	25,920.00	SY	25,233	48,128	25,920	0	0	0	4,651	103,933
(Note: 50 ft x 15 ft / 9 sf/sy = 83 sy Section. Say 1/2 hr to place a section. 83 sy x 2 = 164 sy hr. Use 200 sy/hr. Includes overlap)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*1,250.00*
Outfall Relocation	**1,600.00**	**LF**	**0**	**0**	**0**	**0**	**2,000,000**	**0**	**0**	**2,000,000**
(Note: Relocated First Energy Outfall 203. Outfall to be relocated through the west arm of the first phase of the CDF. No sizes given. Assume the East 20 th street design from Cleveland 10b CDF.)										
			0.00	*0.00*	*0.00*	*0.00*	*1,250.00*	*0.00*	*0.00*	*1,250.00*
USR Outfall Relocation	1,600.00	LF	0	0	0	0	2,000,000	0	0	2,000,000
(Note: From Cleveland CDF 10B E20th Street outfall -171" x 110" Corr Steel Pipe Arch. Low Bidders unit Cost updated by ENR to current date.)										
Phase 3	**1.00**	**LS**	**5,543,679**	**16,799,804**	**61,895,207**	**15,600**	**0**	**0**	**1,008,703**	**85,262,993**
			440,486.88	*441,169.45*	*31,600.00*	*15,600.00*			*77,624.11*	*1,006,480.44*
General Conditions	**1.00**	**EA**	**440,487**	**441,169**	**31,600**	**15,600**	**0**	**0**	**77,624**	**1,006,480**
			14,526.72	*0.00*	*14,400.00*	*15,600.00*			*2,488.74*	*47,015.46*
Temporary Office	**1.00**	**EA**	**14,527**	**0**	**14,400**	**15,600**	**0**	**0**	**2,489**	**47,015**
			0.00	*0.00*	*300.00*	*0.00*	*0.00*	*0.00*	*0.00*	*300.00*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	UserCost1	UserCost2	DirectMU	DirectCost
AF 015205000550 Office Trailer, furnished, rent per month, 50' x 12', excl. hookups	36.00	MO	0	0	10,800	0	0	0	0	10,800
			0.00	*0.00*	*0.00*	*400.00*	*0.00*	*0.00*	*0.00*	*400.00*
USR Utility Costs	36.00	MO	0	0	0	14,400	0	0	0	14,400
(Note: Include Electric, Phone, Fax and Supplies)										
USR Mob and Demob Office Trailer	1.00	LS	0	0	0	1,200	0	0	0	1,200
			403.52	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*	*69.13*	*572.65*
USR Janitorial	36.00	MO	14,527	0	3,600	0	0	0	2,489	20,615
Submittals	**1.00**	**LS**	**18,683**	**0**	**10,000**	**0**	**0**	**0**	**3,419**	**32,102**
USR Reproduction and Mail	1.00	LS	0	0	10,000	0	0	0	0	10,000
			622.76	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*113.97*	*736.73*
USR Initial Project Submittals	30.00	DAY	18,683	0	0	0	0	0	3,419	22,102
Mob and Demob	**1.00**	**LS**	**44,772**	**124,984**	**0**	**0**	**0**	**0**	**8,196**	**177,952**
(Note: Assume 3 days initial mob + 2 days demob year 1 + 2 days mob year 2 + 2 days demob year 2 + year 3 (11 days @ 12 hrs/day))										
			144.48	*575.49*	*0.00*	*0.00*	*0.00*	*0.00*	*26.20*	*746.17*
USR 1 tug + 4 barges + 1 Eng + 1 Oper + 2 Tug Workers	132.00	HR	19,071	75,964	0	0	0	0	3,459	98,494
			194.70	*371.36*	*0.00*	*0.00*	*0.00*	*0.00*	*35.89*	*601.95*
USR 1 Spud Barge + 1 Crane + 1 tug + 2 Oper + 2 Deck	132.00	HR	25,700	49,020	0	0	0	0	4,737	79,457
			362,505.60	*316,185.72*	*7,200.00*	*0.00*			*63,520.00*	*749,411.32*
Quality Control On-Site	**1.00**	**EA**	**362,506**	**316,186**	**7,200**	**0**	**0**	**0**	**63,520**	**749,411**
			10,069.60	*8,782.94*	*200.00*	*0.00*	*0.00*	*0.00*	*1,764.44*	*20,816.98*
USR Quality Control	36.00	MO	362,506	316,186	7,200	0	0	0	63,520	749,411
			3.08	*9.21*	*52.50*	*0.00*			*0.56*	*65.35*
Type A	**259,800.00**	**TON**	**800,271**	**2,392,142**	**13,639,500**	**0**	**0**	**0**	**146,279**	**16,978,191**
			1.48	*2.81*	*52.50*	*0.00*	*0.00*	*0.00*	*0.27*	*57.06*
USR Type A Armor Stone (5 ton to 10 ton)	259,800.00	TON	383,205	730,904	13,639,500	0	0	0	70,638	14,824,247
			1.61	*6.39*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.29*
USR Haul from Sandusky	259,800.00	TON	417,066	1,661,238	0	0	0	0	75,641	2,153,945
(Note: 2400 tons per cycle, 24 hrs per cycle)										
			2.75	*8.58*	*48.00*	*0.00*			*0.50*	*59.83*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	UserCost1	UserCost2	DirectMU	DirectCost
Type B	**266,800.00**	**TON**	**733,867**	**2,288,815**	**12,806,400**	**0**	**0**	**0**	**134,005**	**15,963,087**
			1.15	*2.18*	*48.00*	*0.00*	*0.00*	*0.00*	*0.21*	*51.54*
USR Type B Stone (600 lb to 2000 lb) Placed for CDF	266,800.00	TON	305,564	582,817	12,806,400	0	0	0	56,326	13,751,107
			1.61	*6.39*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.29*
USR Haul from Sandusky	266,800.00	TON	428,303	1,705,998	0	0	0	0	77,679	2,211,980
(Note: 2400 tons per cycle, 24 hrs per cycle)										
			2.37	*7.85*	*24.50*	*0.00*			*0.43*	*35.15*
Type C	**956,300.00**	**TON**	**2,265,343**	**7,507,537**	**23,429,350**	**0**	**0**	**0**	**413,023**	**33,615,254**
			0.76	*1.46*	*24.50*	*0.00*	*0.00*	*0.00*	*0.14*	*26.86*
USR Type C Stone	956,300.00	TON	730,163	1,392,672	23,429,350	0	0	0	134,594	25,686,780
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)										
			1.61	*6.39*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.29*
USR Haul from Sandusky	956,300.00	TON	1,535,180	6,114,865	0	0	0	0	278,429	7,928,474
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.29	*7.70*	*7.00*	*0.00*			*0.42*	*17.40*
Type D	**24,500.00**	**TON**	**56,068**	**188,584**	**171,500**	**0**	**0**	**0**	**10,218**	**426,371**
			0.68	*1.30*	*7.00*	*0.00*	*0.00*	*0.00*	*0.13*	*9.11*
USR Type D Stone	24,500.00	TON	16,737	31,924	171,500	0	0	0	3,085	223,247
(Note: (4" Minus) ODOT 703.19A Crushed Ag clev e brkwtr 30/ton)										
			1.61	*6.39*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.29*
USR Haul from Sandusky	24,500.00	TON	39,331	156,660	0	0	0	0	7,133	203,124
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.37	*7.85*	*24.50*	*0.00*			*0.43*	*35.15*
Type E	**389,200.00**	**TON**	**921,961**	**3,055,457**	**9,535,400**	**0**	**0**	**0**	**168,094**	**13,680,913**
			0.76	*1.46*	*24.50*	*0.00*	*0.00*	*0.00*	*0.14*	*26.86*
USR Type C and E Stone	389,200.00	TON	297,166	566,797	9,535,400	0	0	0	54,778	10,454,141
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)										
			1.61	*6.39*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.29*
USR Haul from Sandusky	389,200.00	TON	624,796	2,488,660	0	0	0	0	113,316	3,226,772
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.25	*7.63*	*7.00*	*0.00*			*0.41*	*17.30*
Type F	**77,200.00**	**TON**	**174,035**	**589,203**	**540,400**	**0**	**0**	**0**	**31,713**	**1,335,350**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	UserCost1	UserCost2	DirectMU	DirectCost
			0.65	*1.24*	*7.00*	*0.00*	*0.00*	*0.00*	*0.12*	*9.01*
USR Type F Stone	77,200.00	TON	50,103	95,563	540,400	0	0	0	9,236	695,302
(Note: (3/4" to 1") ODOT 703.01 Size No. 68 clev e brkwtr 20/ton)										
			1.61	*6.39*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.29*
USR Haul from Sandusky	77,200.00	TON	123,932	493,640	0	0	0	0	22,477	640,048
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.51	*8.12*	*30.60*	*0.00*			*0.46*	*41.69*
Type H	**15,500.00**	**TON**	**38,919**	**125,884**	**474,300**	**0**	**0**	**0**	**7,100**	**646,203**
			0.91	*1.73*	*30.60*	*0.00*	*0.00*	*0.00*	*0.17*	*33.40*
USR Type H Stone	15,500.00	TON	14,037	26,772	474,300	0	0	0	2,587	517,696
(Note: (6" - 18") ODOT 703.19B Type C)										
			1.61	*6.39*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.29*
USR Haul from Sandusky	15,500.00	TON	24,883	99,112	0	0	0	0	4,513	128,507
(Note: 2400 tons per trip, 24 hrs per trip)										
			15,454.76	*21,954.08*	*3,516.80*	*0.00*			*2,769.56*	*43,695.19*
Weir and Walkway	**1.00**	**EA**	**15,455**	**21,954**	**3,517**	**0**	**0**	**0**	**2,770**	**43,695**
(Note: Quantities obtained from Dike 10b IGE dated June 1996)										
			14,260.32	*21,810.47*	*1,420.50*	*0.00*			*2,607.48*	*40,098.76*
Wier	**1.00**	**EA**	**14,260**	**21,810**	**1,421**	**0**	**0**	**0**	**2,607**	**40,099**
			15.84	*24.23*	*0.70*	*0.00*	*0.00*	*0.00*	*2.90*	*43.68*
MIL 031104300150 C.I.P. concrete forms, footing, continuous wall, plywood, 4 use, includes erecting, bracing, stripping and cleaning	300.00	SFC	4,753	7,270	210	0	0	0	869	13,103
			2,376.72	*3,635.08*	*541.50*	*0.00*	*0.00*	*0.00*	*434.58*	*6,987.88*
MIL 032106000700 Reinforcing steel, in place, walls, #3 to #7, A615, grade 60	1.00	TON	2,377	3,635	542	0	0	0	435	6,988
			396.12	*605.85*	*0.00*	*0.00*	*0.00*	*0.00*	*72.43*	*1,074.40*
USR 033107005400 Structural concrete, placing, walls, with crane and bucket, 15" thick, includes vibrating, excludes material	6.00	CY	2,377	3,635	0	0	0	0	435	6,446
			0.00	*0.00*	*110.00*	*0.00*	*0.00*	*0.00*	*0.00*	*110.00*
MIL 033102200300 Structural concrete, ready mix, normal weight, 4000 PSI, includes material only	6.00	CY	0	0	660	0	0	0	0	660

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	UserCost1	UserCost2	DirectMU	DirectCost
			15.84	*24.23*	*0.03*	*0.00*	*0.00*	*0.00*	*2.90*	*43.01*
MIL 033503500010 Concrete finishing, walls, includes breaking ties and patching voids	300.00	SF	4,753	7,270	9	0	0	0	869	12,902
			1,194.44	*143.61*	*2,096.30*	*0.00*			*162.08*	*3,596.43*
Walkway, Railing and Ladder	**1.00**	**EA**	**1,194**	**144**	**2,096**	**0**	**0**	**0**	**162**	**3,596**
			7.40	*0.75*	*13.92*	*0.00*	*0.00*	*0.00*	*1.00*	*23.07*
RSM 055207000020 Railing, pipe, aluminum, satin finish, 2 rails, 1-1/4" dia	20.00	LF	148	15	278	0	0	0	20	461
			1.97	*0.20*	*8.86*	*0.00*	*0.00*	*0.00*	*0.27*	*11.30*
MIL 055303400694 Floor grating, steel, galvanized, 1-1/4" x 3/16" bearing bars @ 15/16" O.C., cross bars @ 4" O.C., 9.1 #/S.F., up to 300 S.F.	100.00	SF	197	20	886	0	0	0	27	1,130
			24.70	*3.65*	*4.40*	*0.00*	*0.00*	*0.00*	*3.35*	*36.10*
MIL 051204400672 Channel framing, structural steel, field fabricated, C8x11.5, incl cutting & welding	20.00	LF	494	73	88	0	0	0	67	722
			23.68	*2.39*	*56.26*	*0.00*	*0.00*	*0.00*	*3.21*	*85.54*
MIL 055145000020 Ladder, steel, 20" W, bolted to concrete, incl cage	15.00	VLF	355	36	844	0	0	0	48	1,283
			0.61	*1.20*	*12.34*	*0.00*			*0.11*	*14.27*
Steel Sheet Pile Wall	**99,300.00**	**SF**	**60,825**	**119,540**	**1,225,800**	**0**	**0**	**0**	**11,158**	**1,417,323**
			89.32	*175.54*	*1,800.00*	*0.00*			*16.38*	*2,081.24*
CZ67	**681.00**	**TON**	**60,825**	**119,540**	**1,225,800**	**0**	**0**	**0**	**11,158**	**1,417,323**
			89.32	*175.54*	*1,800.00*	*0.00*	*0.00*	*0.00*	*16.38*	*2,081.24*
USR Marine Sheet piling, steel, 38 psf, 40' excavation, left in place, excludes wales	681.00	TON	60,825	119,540	1,225,800	0	0	0	11,158	1,417,323
(Note: Modified for Marine Plant)										
			1.17	*2.23*	*1.20*	*0.00*			*0.22*	*4.81*
Geotextile	**31,200.00**	**SY**	**36,448**	**69,519**	**37,440**	**0**	**0**	**0**	**6,719**	**150,125**
			0.97	*1.86*	*1.00*	*0.00*	*0.00*	*0.00*	*0.18*	*4.01*
USR Geotextile	37,440.00	SY	36,448	69,519	37,440	0	0	0	6,719	150,125

(Note: 50 ft x 15 ft / 9 sf/sy = 83 sy Section. Say 1/2 hr to place a section. 83 sy x 2 = 164 sy hr. Use 200 sy/hr. Includes overlap.)

Description **Page**

Local Alternative New Layout June 2009 - COMBIWALL

This estimate is from sketches / drawings supplied by Mike Mohr. It is a revision to the 062008 local preferred plan. Due to the amount and lengths of steel LB Foster was contacted for a price quote on the steel. Stone prices are from J. Deans 2006 cost estimate and have been escalated to current price levels.

Estimated by	LRB jw
Designed by	LRB- ftl, mm
Prepared by	James Wryk
Preparation Date	6/5/2009
Effective Date of Pricing	6/5/2009
Estimated Construction Time	Days

Date	Author	Note
6/18/2008	jw	It is anticipated that this CDF loction will be built using marine equipment due to the size of the structure. (Due not want equipment on wall if a storm comes up). Self unloaders hauling smaller core and granular fill may be utilized when possible. Larger stone will be hauled from Sandusky OH.
6/24/2008	jw	Design from F. Lewandowski (SSP System) and stone cross section from M. Mohr. SSP system is a combi-wall system constinting of King Piles with SSP in between. King Piles @ approx. 66 feet and the SSP at approx 125 feet in lengthon the lake side and 140 feet on the CDF side. It is questionable if the piles and the SSP can be purchased and transported in the lengths indicated. From Civil Structural- anticipate that these lengths can be purchased and transported to the job site either by truck, rail or barge for this stae of study.
6/24/2008	jw	Stone costs from Cleveland DMMP study developed in 2006. Price Quotes received for this study.
6/24/2008	jw	Estimate broken into 3 phases starting from the East and working to the west. Because the phases may be completed by different contracts, Mob/Demob, Wier Structure and fish removal is added to all phases of the estimate.
6/24/2008	jw	Most of this cost estimate is taken from previous work such as the Cleveland 10B CDF estimate and the Cleveland DMMP Site #2 estimate. Therefore not a lot of detailed work has been completed. Most of estimate is previous wotk escalated to current price levels and for the stone a single cost developed as described in notes above.
6/24/2008	jw	Estimates DO NOT INCLUDE any dredging that may be required for realignment of the navigation channel that may become necessary due to this alternative.
9/8/2008	jw	Revised estimate include new labor rates and esculated stone price quotes to current (4th Qtr FY08) dollars. Estimate NOT escaluated to Future $$.
9/9/2008	jw	15% contingency has been added to this estimate. In addition the price quote from the quarry is on the conservative side not only because of the opening of a new section of quarry but for the uncertainties in the design at the time of the price quote.
6/10/2009	jw	This combi wall alternative includes a Phase 4 for protection of wave overtopping and berm construction. This estimate was initially copied from earlier estimates math checked for links and adjusted quantities input into the estimate.

Description	Quantity	UOM	ContractCost	Escalation	Contingency	ProjectCost
Project Cost Summary Report			**296,716,406**	**26,467,103**	**32,318,351**	**355,501,860**
Phase 1	**1.00**	**LS**	**123,689,375**	**11,033,092**	**13,472,247**	**148,194,714**
Phase 2	**1.00**	**LS**	**66,488,599**	**5,930,783**	**7,241,938**	**79,661,321**
Phase 3	**1.00**	**LS**	**85,069,125**	**7,588,166**	**9,265,729**	**101,923,020**
Phase 4	**1.00**	**LS**	**21,469,307**	**1,915,062**	**2,338,437**	**25,722,806**

Description	Quantity	UOM	DirectCost	SubCMU	PrimeCMU	ContractCost
Contract Cost Summary Report			**244,777,149**	**0**	**51,939,257**	**296,716,406**
Phase 1	**1.00**	**LS**	**102,807,822**	**0**	**20,881,552**	**123,689,375**
General Conditions	**1.00**	**EA**	*1,012,140.09* **1,012,140**	**0**	**223,071**	*1,235,210.93* **1,235,211**
Temporary Office	**1.00**	**EA**	*47,015.46* **47,015**	**0**	**10,362**	*57,377.45* **57,377**
Submittals	**1.00**	**LS**	**32,102**	**0**	**7,075**	**39,177**
Mob and Demob	**1.00**	**LS**	**181,361**	**0**	**39,971**	**221,332**
Quality Control On-Site	**1.00**	**EA**	*751,662.19* **751,662**	**0**	**165,663**	*917,324.94* **917,325**
PZC 13 Combi-wall	**4,878.00**	**LF**	*16,109.91* **78,584,135**	**0**	**16,286,050**	*19,448.58* **94,870,185**
C King Pile (Beam)	**108,400.00**	**LF**	*268.54* **29,109,314**	**0**	**6,415,554**	*327.72* **35,524,868**
C PZC 13	**9,527.00**	**TON**	*2,432.03* **23,169,970**	**0**	**5,106,551**	*2,968.04* **28,276,521**
C Tie Rods	**398.76**	**EA**	*9,732.87* **3,881,039**	**0**	**855,362**	*11,877.95* **4,736,401**
C Wales	**1,131,696.00**	**LB**	*3.99* **4,514,854**	**0**	**995,052**	*4.87* **5,509,907**
C Concrete Cap	**10,840.00**	**CY**	*432.60* **4,689,384**	**0**	**0**	*432.60* **4,689,384**
Granular Fill	**722,920.00**	**TON**	*18.29* **13,219,573**	**0**	**2,913,531**	*22.32* **16,133,104**
Stone	**1.00**	**LS**	**19,669,828**	**0**	**4,335,136**	**24,004,965**
Type B	**30,200.00**	**TON**	*64.46* **1,946,560**	**0**	**429,013**	*78.66* **2,375,573**
Type C	**401,000.00**	**TON**	*37.63* **15,089,575**	**0**	**3,325,670**	*45.92* **18,415,245**
Type F	**59,700.00**	**TON**	*18.20* **1,086,304**	**0**	**239,416**	*22.21* **1,325,721**
Type H	**34,600.00**	**TON**	*44.72* **1,547,390**	**0**	**341,037**	*54.58* **1,888,427**

Description	Quantity	UOM	DirectCost	SubCMU	PrimeCMU	ContractCost
Weir and Walkway	**1.00**	**EA**	*44,219.23* **44,219**	**0**	**9,746**	*53,964.94* **53,965**
Wier	**1.00**	**EA**	*40,617.92* **40,618**	**0**	**8,952**	*49,569.92* **49,570**
Walkway, Railing and Ladder	**1.00**	**EA**	*3,601.30* **3,601**	**0**	**794**	*4,395.01* **4,395**
Fish Removal	**1.00**	**EA**	*35,000.00* **35,000**	**0**	**0**	*35,000.00* **35,000**
Outfall Relocation	**2,670.00**	**LF**	*1,250.00* **3,337,500**	**0**	**0**	*1,250.00* **3,337,500**
Geotextile	**8,000.00**	**SY**	*15.63* **125,000**	**0**	**27,549**	*19.07* **152,549**
Phase 2	**1.00**	**LS**	**54,481,203**	**0**	**12,007,397**	**66,488,599**
General Conditions	**1.00**	**EA**	*1,012,140.09* **1,012,140**	**0**	**223,071**	*1,235,210.93* **1,235,211**
Temporary Office	**1.00**	**EA**	*47,015.46* **47,015**	**0**	**10,362**	*57,377.45* **57,377**
Submittals	**1.00**	**LS**	**32,102**	**0**	**7,075**	**39,177**
Mob and Demob	**1.00**	**LS**	**181,361**	**0**	**39,971**	**221,332**
Quality Control On-Site	**1.00**	**EA**	*751,662.19* **751,662**	**0**	**165,663**	*917,324.94* **917,325**
PZC 13 Combi-wall	**1,910.00**	**LF**	*16,175.35* **30,894,926**	**0**	**6,809,094**	*19,740.32* **37,704,020**
C King Pile (Beam)	**42,444.44**	**LF**	*268.54* **11,397,866**	**0**	**2,512,035**	*327.72* **13,909,901**
C PZC 13	**3,730.33**	**TON**	*2,432.03* **9,072,293**	**0**	**1,999,490**	*2,968.04* **11,071,782**
C Tie Rods	**156.13**	**EA**	*9,732.87* **1,519,636**	**0**	**334,920**	*11,877.95* **1,854,556**
C Wales	**443,120.00**	**LB**	*3.99* **1,767,809**	**0**	**389,617**	*4.87* **2,157,426**
C Concrete Cap	**4,244.44**	**CY**	*432.60* **1,836,147**	**0**	**404,678**	*527.94* **2,240,825**

Description	Quantity	UOM	DirectCost	SubCMU	PrimeCMU	ContractCost
Granular Fill	**283,062.16**	**TON**	*18.29* **5,176,176**	**0**	**1,140,804**	*22.32* **6,316,980**
Geotextile	**8,000.00**	**SY**	*15.63* **125,000**	**0**	**27,549**	*19.07* **152,549**
Stone	**1.00**	**LS**	**19,032,418**	**0**	**4,194,654**	**23,227,072**
Type B	**29,200.00**	**TON**	*64.46* **1,882,104**	**0**	**414,807**	*78.66* **2,296,911**
Type C	**388,000.00**	**TON**	*37.63* **14,600,386**	**0**	**3,217,855**	*45.92* **17,818,242**
Type F	**57,800.00**	**TON**	*18.20* **1,051,732**	**0**	**231,797**	*22.21* **1,283,528**
Type H	**33,500.00**	**TON**	*44.72* **1,498,195**	**0**	**330,195**	*54.58* **1,828,390**
Weir and Walkway	**1.00**	**EA**	*44,219.23* **44,219**	**0**	**9,746**	*53,964.94* **53,965**
Wier	**1.00**	**EA**	*40,617.92* **40,618**	**0**	**8,952**	*49,569.92* **49,570**
Walkway, Railing and Ladder	**1.00**	**EA**	*3,601.30* **3,601**	**0**	**794**	*4,395.01* **4,395**
Fish Removal	**1.00**	**EA**	*35,000.00* **35,000**	**0**	**7,714**	*42,713.83* **42,714**
Outfall Relocation	**2,670.00**	**LF**	*1,250.00* **3,337,500**	**0**	**735,569**	*1,525.49* **4,073,069**
Geotextile	**7,600.00**	**SY**	*16.45* **125,000**	**0**	**27,549**	*20.07* **152,549**
Phase 3	**1.00**	**LS**	**69,706,209**	**0**	**15,362,916**	**85,069,125**
General Conditions	**1.00**	**EA**	*1,012,140.09* **1,012,140**	**0**	**223,071**	*1,235,210.93* **1,235,211**
Temporary Office	**1.00**	**EA**	*47,015.46* **47,015**	**0**	**10,362**	*57,377.45* **57,377**
Submittals	**1.00**	**LS**	**32,102**	**0**	**7,075**	**39,177**
Mob and Demob	**1.00**	**LS**	**181,361**	**0**	**39,971**	**221,332**

Description	Quantity	UOM	DirectCost	SubCMU	PrimeCMU	ContractCost
Quality Control On-Site	**1.00**	**EA**	*751,662.19* **751,662**	**0**	**165,663**	*917,324.94* **917,325**
PZC 13 Combi-wall	**4,052.00**	**LF**	*16,109.91* **65,277,350**	**0**	**14,386,816**	*19,660.46* **79,664,166**
C King Pile (Beam)	**90,044.44**	**LF**	*268.54* **24,180,185**	**0**	**5,329,197**	*327.72* **29,509,382**
C PZC 13	**7,913.78**	**TON**	*2,432.03* **19,246,560**	**0**	**4,241,850**	*2,968.04* **23,488,410**
C Tie Rods	**331.23**	**EA**	*9,732.87* **3,223,856**	**0**	**710,522**	*11,877.95* **3,934,378**
C Wales	**940,064.00**	**LB**	*3.99* **3,750,347**	**0**	**826,558**	*4.87* **4,576,905**
C Concrete Cap	**9,004.44**	**CY**	*432.60* **3,895,323**	**0**	**858,511**	*527.94* **4,753,833**
Granular Fill	**600,506.73**	**TON**	*18.29* **10,981,081**	**0**	**2,420,178**	*22.32* **13,401,258**
Weir and Walkway	**1.00**	**EA**	*44,219.23* **44,219**	**0**	**9,746**	*53,964.94* **53,965**
Wier	**1.00**	**EA**	*40,617.92* **40,618**	**0**	**8,952**	*49,569.92* **49,570**
Walkway, Railing and Ladder	**1.00**	**EA**	*3,601.30* **3,601**	**0**	**794**	*4,395.01* **4,395**
Fish Removal	**1.00**	**EA**	*35,000.00* **35,000**	**0**	**7,714**	*42,713.83* **42,714**
Outfall Relocation	**2,670.00**	**LF**	*1,250.00* **3,337,500**	**0**	**735,569**	*1,525.49* **4,073,069**
Phase 4	**1.00**	**LS**	**17,781,915**	**0**	**3,687,392**	**21,469,307**
Berms	**68,300.00**	**CY**	*15.61* **1,066,486**	**0**	**3,391**	*15.66* **1,069,877**
Initial Raising	**52,300.00**	**CY**	*11.50* **601,450**	**0**	**0**	*11.50* **601,450**
Final Raising	**39,100.00**	**CY**	*11.50* **449,650**	**0**	**0**	*11.50* **449,650**

Description	Quantity	UOM	DirectCost	SubCMU	PrimeCMU	ContractCost
			0.96			*1.17*
Berm Removal	**16,000.00**	**CY**	**15,386**	**0**	**3,391**	**18,777**
			65.61			*80.07*
Type A	**166,700.00**	**TON**	**10,937,103**	**0**	**2,410,485**	**13,347,589**
			60.08			*73.32*
Type B	**62,500.00**	**TON**	**3,754,783**	**0**	**827,536**	**4,582,319**
			35.38			*43.18*
Type E	**30,600.00**	**TON**	**1,082,642**	**0**	**238,609**	**1,321,251**
			4.86			*5.93*
Geotextile	**27,000.00**	**SY**	**131,219**	**0**	**28,920**	**160,139**
			65.30			*79.69*
Concrete Mat	**12,400.00**	**SY**	**809,681**	**0**	**178,450**	**988,131**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
Project Direct Costs Report			**17,183,270**	**34,523,148**	**167,934,644**	**46,800**	**21,589,453**	**375,000**	**3,124,834**	**244,777,149**
Phase 1	**1.00**	**LS**	**7,256,321**	**14,758,064**	**71,270,831**	**15,600**	**8,061,884**	**125,000**	**1,320,122**	**102,807,822**
(Note: Eastern section of entire CDF area from the West end of the Marina to the First Energy Outfall. Stone prices from Cleveland DMMP 2006 Estimates from Jim Dean.)										
			440,486.88	*446,829.10*	*31,600.00*	*15,600.00*			*77,624.11*	*1,012,140.09*
General Conditions	**1.00**	**EA**	**440,487**	**446,829**	**31,600**	**15,600**	**0**	**0**	**77,624**	**1,012,140**
			14,526.72	*0.00*	*14,400.00*	*15,600.00*			*2,488.74*	*47,015.46*
Temporary Office	**1.00**	**EA**	**14,527**	**0**	**14,400**	**15,600**	**0**	**0**	**2,489**	**47,015**
			0.00	*0.00*	*300.00*	*0.00*	*0.00*	*0.00*	*0.00*	*300.00*
AF 015205000550 Office Trailer, furnished, rent per month, 50' x 12', excl. hookups	36.00	MO	0	0	10,800	0	0	0	0	10,800
			0.00	*0.00*	*0.00*	*400.00*	*0.00*	*0.00*	*0.00*	*400.00*
USR Utility Costs	36.00	MO	0	0	0	14,400	0	0	0	14,400
(Note: Include Electric, Phone, Fax and Supplies)										
USR Mob and Demob Office Trailer	1.00	LS	0	0	0	1,200	0	0	0	1,200
			403.52	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*	*69.13*	*572.65*
USR Janitorial	36.00	MO	14,527	0	3,600	0	0	0	2,489	20,615
Submittals	**1.00**	**LS**	**18,683**	**0**	**10,000**	**0**	**0**	**0**	**3,419**	**32,102**
USR Reproduction and Mail	1.00	LS	0	0	10,000	0	0	0	0	10,000
			622.76	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*113.97*	*736.73*
USR Initial Project Submittals	30.00	DAY	18,683	0	0	0	0	0	3,419	22,102
Mob and Demob	**1.00**	**LS**	**44,772**	**128,393**	**0**	**0**	**0**	**0**	**8,196**	**181,361**
(Note: Assume 3 days initial mob + 2 days demob year 1 + 2 days mob year 2 + 2 days demob year 2 + year 3 (11 days @ 12 hrs/day))										
			144.48	*593.27*	*0.00*	*0.00*	*0.00*	*0.00*	*26.20*	*763.95*
USR 1 tug + 4 barges + 1 Eng + 1 Oper + 2 Tug Workers	132.00	HR	19,071	78,311	0	0	0	0	3,459	100,841
			194.70	*379.40*	*0.00*	*0.00*	*0.00*	*0.00*	*35.89*	*609.99*
USR 1 Spud Barge + 1 Crane + 1 tug + 2 Oper + 2 Deck	132.00	HR	25,700	50,081	0	0	0	0	4,737	80,519
			362,505.60	*318,436.58*	*7,200.00*	*0.00*			*63,520.00*	*751,662.19*
Quality Control On-Site	**1.00**	**EA**	**362,506**	**318,437**	**7,200**	**0**	**0**	**0**	**63,520**	**751,662**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			10,069.60	*8,845.46*	*200.00*	*0.00*	*0.00*	*0.00*	*1,764.44*	*20,879.51*
USR Quality Control	36.00	MO	362,506	318,437	7,200	0	0	0	63,520	751,662
			1,133.09	*2,054.97*	*11,753.90*	*0.00*			*206.62*	*16,109.91*
PZC 13 Combi-wall	**4,878.00**	**LF**	**5,527,204**	**10,024,153**	**57,335,520**	**0**	**4,689,384**	**0**	**1,007,874**	**78,584,135**
(Note: First phase Combi-Wall approx.2887 lf Beam - W40 x 215 @ 73.45" (6.12') centers @ 68 feet long. Attached to the beams are connnectors welded to the beam for the PZC13 to insert into. PZC 13 @ 90 foot lengths. Anticipate that the sheet pile wall will be constructed after the west end of the breakwater is out of the water. Fill material should be available to be placed out to the location and as the wall is built the equipment should be able to be driven out onto the pier similar to the Chicago Shoreline Beach Piers.)										
			6.15	*6.86*	*254.40*	*0.00*			*1.12*	*268.54*
C King Pile (Beam)	**108,400.00**	**LF**	**666,775**	**743,727**	**27,576,890**	**0**	**0**	**0**	**121,921**	**29,109,314**
(Note: Includes BBS-M and BBS-F King piles are 68 feet in length. Lengths are on the high end for transportation purposes. From Civil/Structural Design assume that the lengths can be made and delivered without any splicing required at this point in the study.)										
			0.00	*0.00*	*2,165.00*	*0.00*	*0.00*	*0.00*	*0.00*	*2,165.00*
USR Material Price King Pile & connectors	12,737.59	TON	0	0	27,576,890	0	0	0	0	27,576,890
(Note: Connectors welded to pile.)										
			6.15	*6.86*	*0.00*	*0.00*	*0.00*	*0.00*	*1.12*	*14.14*
USR King pile installation	108,400.00	LF	666,775	743,727	0	0	0	0	121,921	1,532,424
(Note: Say 1 pile at 66 ft per hour due to tolerances.)										
			172.75	*192.69*	*2,035.00*	*0.00*			*31.59*	*2,432.03*
C PZC 13	**9,527.00**	**TON**	**1,645,820**	**1,835,764**	**19,387,445**	**0**	**0**	**0**	**300,942**	**23,169,970**
(Note: SSP piles are 125-140 feet in length. Lengths are on the high end for transportation purposes. From Civil/Structural Design assume that the lengths can be made and delivered without any splicing required at this point in the study.)										
			172.75	*192.69*	*0.00*	*0.00*	*0.00*	*0.00*	*31.59*	*397.03*
USR Steel Sheet Pile Installation	9,527.00	TON	1,645,820	1,835,764	0	0	0	0	300,942	3,782,525
(Note: 125 -140 foot sheets approx 2 ft wide @ say 2.0 sheets per hour = 250-280 sf/hr Reduce crew output due to need to thread in SSP at both sides and tight tolerances.)										
			0.00	*0.00*	*2,035.00*	*0.00*	*0.00*	*0.00*	*0.00*	*2,035.00*
USR Material Price SSP	9,527.00	TON	0	0	19,387,445	0	0	0	0	19,387,445
			1,408.84	*1,567.69*	*6,500.00*	*0.00*			*256.34*	*9,732.87*
C Tie Rods	**398.76**	**EA**	**561,783**	**625,124**	**2,591,913**	**0**	**0**	**0**	**102,219**	**3,881,039**
			0.87	*0.96*	*4.00*	*0.00*	*0.00*	*0.00*	*0.16*	*5.99*
USR Wale & Tie Rod installation	647,978.18	LB	561,783	625,124	2,591,913	0	0	0	102,219	3,881,039

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
(Note: Reviewed the Chicago Shoreline beach job and price quote for wales @ $1.38/lb. Update due to current rates Use $2.00/lb ADJUST PRICE OF TIE RODS (DOUBLE THAT OF WALES).)										
			0.87	*0.96*	*2.00*	*0.00*			*0.16*	*3.99*
C Wales	**1,131,696.00**	**LB**	**981,156**	**1,091,781**	**2,263,392**	**0**	**0**	**0**	**178,525**	**4,514,854**
			0.87	*0.96*	*2.00*	*0.00*	*0.00*	*0.00*	*0.16*	*3.99*
USR Wale & Tie Rod installation	1,131,696.00	LB	981,156	1,091,781	2,263,392	0	0	0	178,525	4,514,854
(Note: Reviewed the Chicago Shoreline beach job and price quote for wales @ $1.38/lb. Update due to current rates Use $2.00/lb)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*432.60*
C Concrete Cap	**10,840.00**	**CY**	**0**	**0**	**0**	**0**	**4,689,384**	**0**	**0**	**4,689,384**
			0.00	*0.00*	*0.00*	*0.00*	*412.00*	*0.00*	*0.00*	*412.00*
USR Concrete Cap	11,382.00	CY	0	0	0	0	4,689,384	0	0	4,689,384
(Note: From Chicago Shoreline 40-41 beach estimate approx. $400/cy Updated using ENR June 08 - June 07 = 1.03 = $412/cy (includes reinforcing and formwork). Add 5% to Qty for waste. Leave contractor unassigned as bid abstract price includes OH & Profit.)										
			2.31	*7.92*	*7.63*	*0.00*			*0.42*	*18.29*
Granular Fill	**722,920.00**	**TON**	**1,671,670**	**5,727,757**	**5,515,880**	**0**	**0**	**0**	**304,267**	**13,219,573**
(Note: Use Type D material.)										
			0.71	*1.33*	*7.63*	*0.00*	*0.00*	*0.00*	*0.13*	*9.80*
USR Type D Stone	722,920.00	TON	511,142	962,384	5,515,880	0	0	0	93,787	7,083,193
(Note: (4" Minus) ODOT 703.19A Crushed Ag clev e brkwtr 30/ton)										
			1.61	*6.59*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.49*
USR Haul from Sandusky	722,920.00	TON	1,160,528	4,765,373	0	0	0	0	210,480	6,136,381
(Note: 2400 tons per trip, 24 hrs per trip)										
Stone	**1.00**	**LS**	**1,273,175**	**4,264,604**	**13,900,195**	**0**	**0**	**0**	**231,854**	**19,669,828**
			2.80	*8.82*	*52.32*	*0.00*			*0.51*	*64.46*
Type B	**30,200.00**	**TON**	**84,600**	**266,474**	**1,580,064**	**0**	**0**	**0**	**15,422**	**1,946,560**
			1.20	*2.23*	*52.32*	*0.00*	*0.00*	*0.00*	*0.22*	*55.97*
USR Type B Stone (600 lb to 2000 lb) Placed for CDF	30,200.00	TON	36,119	67,400	1,580,064	0	0	0	6,629	1,690,213
			1.61	*6.59*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.49*
USR Haul from Sandusky	30,200.00	TON	48,481	199,074	0	0	0	0	8,793	256,347
(Note: 2400 tons per cycle, 24 hrs per cycle)										
			2.40	*8.08*	*26.71*	*0.00*			*0.44*	*37.63*
Type C	**401,000.00**	**TON**	**963,469**	**3,239,961**	**10,710,710**	**0**	**0**	**0**	**175,434**	**15,089,575**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			0.80	*1.49*	*26.71*	*0.00*	*0.00*	*0.00*	*0.15*	*29.14*
USR Type C Stone	401,000.00	TON	319,731	596,633	10,710,710	0	0	0	58,682	11,685,756
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)										
			1.61	*6.59*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.49*
USR Haul from Sandusky	401,000.00	TON	643,739	2,643,328	0	0	0	0	116,752	3,403,819
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.29	*7.86*	*7.63*	*0.00*			*0.42*	*18.20*
Type F	**59,700.00**	**TON**	**136,840**	**469,034**	**455,511**	**0**	**0**	**0**	**24,918**	**1,086,304**
			0.69	*1.26*	*7.63*	*0.00*	*0.00*	*0.00*	*0.13*	*9.71*
USR Type F Stone	59,700.00	TON	41,002	75,502	455,511	0	0	0	7,537	579,551
(Note: (3/4" to 1") ODOT 703.01 Size No. 68 clev e brkwtr 20/ton)										
			1.61	*6.59*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.49*
USR Haul from Sandusky	59,700.00	TON	95,838	393,533	0	0	0	0	17,382	506,753
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.55	*8.36*	*33.35*	*0.00*			*0.46*	*44.72*
Type H	**34,600.00**	**TON**	**88,265**	**289,135**	**1,153,910**	**0**	**0**	**0**	**16,079**	**1,547,390**
			0.95	*1.76*	*33.35*	*0.00*	*0.00*	*0.00*	*0.17*	*36.23*
USR Type H Stone	34,600.00	TON	32,720	61,058	1,153,910	0	0	0	6,005	1,253,693
(Note: (6" - 18") ODOT 703.19B Type C)										
			1.61	*6.59*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.49*
USR Haul from Sandusky	34,600.00	TON	55,545	228,078	0	0	0	0	10,074	293,696
(Note: 2400 tons per trip, 24 hrs per trip)										
			15,454.76	*22,478.11*	*3,516.80*	*0.00*			*2,769.56*	*44,219.23*
Weir and Walkway	**1.00**	**EA**	**15,455**	**22,478**	**3,517**	**0**	**0**	**0**	**2,770**	**44,219**
(Note: Quantities obtained from Dike 10b IGE dated June 1996)										
			14,260.32	*22,329.63*	*1,420.50*	*0.00*			*2,607.48*	*40,617.92*
Wier	**1.00**	**EA**	**14,260**	**22,330**	**1,421**	**0**	**0**	**0**	**2,607**	**40,618**
			15.84	*24.81*	*0.70*	*0.00*	*0.00*	*0.00*	*2.90*	*44.25*
MIL 031104300150 C.I.P. concrete forms, footing, continuous wall, plywood, 4 use, includes erecting, bracing, stripping and cleaning	300.00	SFC	4,753	7,443	210	0	0	0	869	13,276
			2,376.72	*3,721.60*	*541.50*	*0.00*	*0.00*	*0.00*	*434.58*	*7,074.40*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
MIL 032106000700 Reinforcing steel, in place, walls, #3 to #7, A615, grade 60	1.00	TON	2,377	3,722	542	0	0	0	435	7,074
			396.12	*620.27*	*0.00*	*0.00*	*0.00*	*0.00*	*72.43*	*1,088.82*
USR 033107005400 Structural concrete, placing, walls, with crane and bucket, 15" thick, includes vibrating, excludes material	6.00	CY	2,377	3,722	0	0	0	0	435	6,533
			0.00	*0.00*	*110.00*	*0.00*	*0.00*	*0.00*	*0.00*	*110.00*
MIL 033102200300 Structural concrete, ready mix, normal weight, 4000 PSI, includes material only	6.00	CY	0	0	660	0	0	0	0	660
			15.84	*24.81*	*0.03*	*0.00*	*0.00*	*0.00*	*2.90*	*43.58*
MIL 033503500010 Concrete finishing, walls, includes breaking ties and patching voids	300.00	SF	4,753	7,443	9	0	0	0	869	13,075
			1,194.44	*148.49*	*2,096.30*	*0.00*			*162.08*	*3,601.30*
Walkway, Railing and Ladder	**1.00**	**EA**	**1,194**	**148**	**2,096**	**0**	**0**	**0**	**162**	**3,601**
			7.40	*0.77*	*13.92*	*0.00*	*0.00*	*0.00*	*1.00*	*23.10*
RSM 055207000020 Railing, pipe, aluminum, satin finish, 2 rails, 1-1/4" dia	20.00	LF	148	15	278	0	0	0	20	462
			1.97	*0.21*	*8.86*	*0.00*	*0.00*	*0.00*	*0.27*	*11.31*
MIL 055303400694 Floor grating, steel, galvanized, 1-1/4" x 3/16" bearing bars @ 15/16" O.C., cross bars @ 4" O.C., 9.1 #/S.F., up to 300 S.F.	100.00	SF	197	21	886	0	0	0	27	1,131
			24.70	*3.77*	*4.40*	*0.00*	*0.00*	*0.00*	*3.35*	*36.22*
MIL 051204400672 Channel framing, structural steel, field fabricated, C8x11.5, incl cutting & welding	20.00	LF	494	75	88	0	0	0	67	724
			23.68	*2.47*	*56.26*	*0.00*	*0.00*	*0.00*	*3.21*	*85.62*
MIL 055145000020 Ladder, steel, 20" W, bolted to concrete, incl cage	15.00	VLF	355	37	844	0	0	0	48	1,284

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*35,000.00*
Fish Removal	**1.00**	**EA**	**0**	**0**	**0**	**0**	**35,000**	**0**	**0**	**35,000**
USR Fish Removal	1.00	LS	0	0	0	0	35,000	0	0	35,000
(Note: From Cleveland 10 B.)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*1,250.00*
Outfall Relocation	**2,670.00**	**LF**	**0**	**0**	**0**	**0**	**3,337,500**	**0**	**0**	**3,337,500**
(Note: Relocated First Energy Outfall 002 & 003. Outfalls to be relocated through the west arm of the first phase of the CDF. No sizes given. Assume the East 20 th street design from Cleveland 10b CDF.)										
			0.00	*0.00*	*0.00*	*0.00*	*1,250.00*	*0.00*	*0.00*	*1,250.00*
USR Outfall Relocation	2,670.00	LF	0	0	0	0	3,337,500	0	0	3,337,500
(Note: From Cleveland CDF 10B E20th Street outfall -171" x 110" Corr Steel Pipe Arch. Low Bidders unit Cost updated by ENR to current date. Unit price include OH & Profit. Leave assigned contractor as - (Unassigned).)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*15.63*
Geotextile	**8,000.00**	**SY**	**0**	**0**	**0**	**0**	**0**	**125,000**	**0**	**125,000**
			0.00	*0.00*	*0.00*	*0.00*	*0.00*	*5.00*	*0.00*	*5.00*
USR Geotextile	25,000.00	SY	0	0	0	0	0	125,000	0	125,000
(Note: Estimaors judgement from past projects.)										
Phase 2	**1.00**	**LS**	**3,852,118**	**8,520,929**	**35,934,527**	**15,600**	**5,208,647**	**250,000**	**699,383**	**54,481,203**
(Note: Eastern section of entire CDF area from the West end of the Marina to the First Energy Outfall. Stone prices from Cleveland DMMP 2006 Estimates from Jim Dean.)										
			440,486.88	*446,829.10*	*31,600.00*	*15,600.00*			*77,624.11*	*1,012,140.09*
General Conditions	**1.00**	**EA**	**440,487**	**446,829**	**31,600**	**15,600**	**0**	**0**	**77,624**	**1,012,140**
			14,526.72	*0.00*	*14,400.00*	*15,600.00*			*2,488.74*	*47,015.46*
Temporary Office	**1.00**	**EA**	**14,527**	**0**	**14,400**	**15,600**	**0**	**0**	**2,489**	**47,015**
			0.00	*0.00*	*300.00*	*0.00*	*0.00*	*0.00*	*0.00*	*300.00*
AF 015205000550 Office Trailer, furnished, rent per month, 50' x 12', excl. hookups	36.00	MO	0	0	10,800	0	0	0	0	10,800
			0.00	*0.00*	*0.00*	*400.00*	*0.00*	*0.00*	*0.00*	*400.00*
USR Utility Costs	36.00	MO	0	0	0	14,400	0	0	0	14,400
(Note: Include Electric, Phone, Fax and Supplies)										
USR Mob and Demob Office Trailer	1.00	LS	0	0	0	1,200	0	0	0	1,200

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			403.52	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*	*69.13*	*572.65*
USR Janitorial	36.00	MO	14,527	0	3,600	0	0	0	2,489	20,615
Submittals	**1.00**	**LS**	**18,683**	**0**	**10,000**	**0**	**0**	**0**	**3,419**	**32,102**
USR Reproduction and Mail	1.00	LS	0	0	10,000	0	0	0	0	10,000
			622.76	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*113.97*	*736.73*
USR Initial Project Submittals	30.00	DAY	18,683	0	0	0	0	0	3,419	22,102
Mob and Demob	**1.00**	**LS**	**44,772**	**128,393**	**0**	**0**	**0**	**0**	**8,196**	**181,361**
(Note: Assume 3 days initial mob + 2 days demob year 1 + 2 days mob year 2 + 2 days demob year 2 + year 3 (11 days @ 12 hrs/day))										
			144.48	*593.27*	*0.00*	*0.00*	*0.00*	*0.00*	*26.20*	*763.95*
USR 1 tug + 4 barges + 1 Eng + 1 Oper + 2 Tug Workers	132.00	HR	19,071	78,311	0	0	0	0	3,459	100,841
			194.70	*379.40*	*0.00*	*0.00*	*0.00*	*0.00*	*35.89*	*609.99*
USR 1 Spud Barge + 1 Crane + 1 tug + 2 Oper + 2 Deck	132.00	HR	25,700	50,081	0	0	0	0	4,737	80,519
			362,505.60	*318,436.58*	*7,200.00*	*0.00*			*63,520.00*	*751,662.19*
Quality Control On-Site	**1.00**	**EA**	**362,506**	**318,437**	**7,200**	**0**	**0**	**0**	**63,520**	**751,662**
			10,069.60	*8,845.46*	*200.00*	*0.00*	*0.00*	*0.00*	*1,764.44*	*20,879.51*
USR Quality Control	36.00	MO	362,506	318,437	7,200	0	0	0	63,520	751,662
			1,133.09	*2,054.97*	*11,753.90*	*0.00*			*206.62*	*16,175.35*
PZC 13 Combi-wall	**1,910.00**	**LF**	**2,164,198**	**3,924,996**	**22,449,947**	**0**	**1,836,147**	**125,000**	**394,637**	**30,894,926**
(Note: First phase Combi-Wall approx.2887 lf Beam - W40 x 215 @ 73.45" (6.12') centers @ 68 feet long. Attached to the beams are connnectors welded to the beam for the PZC13 to insert into. PZC 13 @ 90 foot lengths. Anticipate that the sheet pile wall will be constructed after the west end of the breakwater is out of the water. Fill material should be available to be placed out to the location and as the wall is built the equipment should be able to be driven out onto the pier similar to the Chicago Shoreline Beach Piers.)										
			6.15	*6.86*	*254.40*	*0.00*			*1.12*	*268.54*
C King Pile (Beam)	**42,444.44**	**LF**	**261,078**	**291,209**	**10,797,839**	**0**	**0**	**0**	**47,739**	**11,397,866**
(Note: Includes BBS-M and BBS-F King piles are 68 feet in length. Lengths are on the high end for transportation purposes. From Civil/Structural Design assume that the lengths can be made and delivered without any splicing required at this point in the study.)										
			0.00	*0.00*	*2,165.00*	*0.00*	*0.00*	*0.00*	*0.00*	*2,165.00*
USR Material Price King Pile & connectors	4,987.45	TON	0	0	10,797,839	0	0	0	0	10,797,839
(Note: Connectors welded to pile.)										
			6.15	*6.86*	*0.00*	*0.00*	*0.00*	*0.00*	*1.12*	*14.14*
USR King pile installation	42,444.44	LF	261,078	291,209	0	0	0	0	47,739	600,027

(Note: Say 1 pile at 66 ft per hour due to tolerances.)

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			172.75	*192.69*	*2,035.00*	*0.00*			*31.59*	*2,432.03*
C PZC 13	**3,730.33**	**TON**	**644,427**	**718,800**	**7,591,230**	**0**	**0**	**0**	**117,835**	**9,072,293**

(Note: SSP piles are 125-140 feet in length. Lengths are on the high end for transportation purposes. From Civil/Structural Design assume that the lengths can be made and delivered without any splicing required at this point in the study.)

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			172.75	*192.69*	*0.00*	*0.00*	*0.00*	*0.00*	*31.59*	*397.03*
USR Steel Sheet Pile Installation	3,730.33	TON	644,427	718,800	0	0	0	0	117,835	1,481,063

(Note: 125 -140 foot sheets approx 2 ft wide @ say 2.0 sheets per hour = 250-280 sf/hr Reduce crew output due to need to thread in SSP at both sides and tight tolerances.)

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			0.00	*0.00*	*2,035.00*	*0.00*	*0.00*	*0.00*	*0.00*	*2,035.00*
USR Material Price SSP	3,730.33	TON	0	0	7,591,230	0	0	0	0	7,591,230
			1,408.84	*1,567.69*	*6,500.00*	*0.00*			*256.34*	*9,732.87*
C Tie Rods	**156.13**	**EA**	**219,968**	**244,770**	**1,014,874**	**0**	**0**	**0**	**40,024**	**1,519,636**
			0.87	*0.96*	*4.00*	*0.00*	*0.00*	*0.00*	*0.16*	*5.99*
USR Wale & Tie Rod installation	253,718.39	LB	219,968	244,770	1,014,874	0	0	0	40,024	1,519,636

(Note: Reviewed the Chicago Shoreline beach job and price quote for wales @ $1.38/lb. Update due to current rates Use $2.00/lb ADJUST PRICE OF TIE RODS (DOUBLE THAT OF WALES).)

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			0.87	*0.96*	*2.00*	*0.00*			*0.16*	*3.99*
C Wales	**443,120.00**	**LB**	**384,176**	**427,491**	**886,240**	**0**	**0**	**0**	**69,902**	**1,767,809**
			0.87	*0.96*	*2.00*	*0.00*	*0.00*	*0.00*	*0.16*	*3.99*
USR Wale & Tie Rod installation	443,120.00	LB	384,176	427,491	886,240	0	0	0	69,902	1,767,809

(Note: Reviewed the Chicago Shoreline beach job and price quote for wales @ $1.38/lb. Update due to current rates Use $2.00/lb)

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*432.60*
C Concrete Cap	**4,244.44**	**CY**	**0**	**0**	**0**	**0**	**1,836,147**	**0**	**0**	**1,836,147**
			0.00	*0.00*	*0.00*	*0.00*	*412.00*	*0.00*	*0.00*	*412.00*
USR Concrete Cap	4,456.67	CY	0	0	0	0	1,836,147	0	0	1,836,147

(Note: From Chicago Shoreline 40-41 beach estimate approx. $400/cy Updated using ENR June 08 - June 07 = 1.03 = $412/cy (includes reinforcing and formwork). Add 5% to Qty for waste. Leave contractor unassigned as bid abstract price includes OH & Profit.)

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			2.31	*7.92*	*7.63*	*0.00*			*0.42*	*18.29*
Granular Fill	**283,062.16**	**TON**	**654,549**	**2,242,726**	**2,159,764**	**0**	**0**	**0**	**119,137**	**5,176,176**

(Note: Use Type D material.)

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			0.71	*1.33*	*7.63*	*0.00*	*0.00*	*0.00*	*0.13*	*9.80*
USR Type D Stone	283,062.16	TON	200,140	376,825	2,159,764	0	0	0	36,723	2,773,452

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
(Note: (4" Minus) ODOT 703.19A Crushed Ag clev e brkwtr 30/ton)										
			1.61	*6.59*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.49*
USR Haul from Sandusky	283,062.16	TON	454,409	1,865,901	0	0	0	0	82,414	2,402,724
(Note: 2400 tons per trip, 24 hrs per trip)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*15.63*
Geotextile	**8,000.00**	**SY**	**0**	**0**	**0**	**0**	**0**	**125,000**	**0**	**125,000**
			0.00	*0.00*	*0.00*	*0.00*	*0.00*	*5.00*	*0.00*	*5.00*
USR Geotextile	25,000.00	SY	0	0	0	0	0	125,000	0	125,000
(Note: Estimaors judgement from past projects.)										
Stone	**1.00**	**LS**	**1,231,978**	**4,126,625**	**13,449,463**	**0**	**0**	**0**	**224,352**	**19,032,418**
			2.80	*8.82*	*52.32*	*0.00*			*0.51*	*64.46*
Type B	**29,200.00**	**TON**	**81,799**	**257,650**	**1,527,744**	**0**	**0**	**0**	**14,911**	**1,882,104**
			1.20	*2.23*	*52.32*	*0.00*	*0.00*	*0.00*	*0.22*	*55.97*
USR Type B Stone (600 lb to 2000 lb) Placed for CDF	29,200.00	TON	34,923	65,168	1,527,744	0	0	0	6,410	1,634,245
			1.61	*6.59*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.49*
USR Haul from Sandusky	29,200.00	TON	46,876	192,482	0	0	0	0	8,502	247,859
(Note: 2400 tons per cycle, 24 hrs per cycle)										
			2.40	*8.08*	*26.71*	*0.00*			*0.44*	*37.63*
Type C	**388,000.00**	**TON**	**932,235**	**3,134,925**	**10,363,480**	**0**	**0**	**0**	**169,747**	**14,600,386**
			0.80	*1.49*	*26.71*	*0.00*	*0.00*	*0.00*	*0.15*	*29.14*
USR Type C Stone	388,000.00	TON	309,365	577,291	10,363,480	0	0	0	56,780	11,306,916
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)										
			1.61	*6.59*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.49*
USR Haul from Sandusky	388,000.00	TON	622,869	2,557,634	0	0	0	0	112,967	3,293,470
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.29	*7.86*	*7.63*	*0.00*			*0.42*	*18.20*
Type F	**57,800.00**	**TON**	**132,485**	**454,107**	**441,014**	**0**	**0**	**0**	**24,125**	**1,051,732**
			0.69	*1.26*	*7.63*	*0.00*	*0.00*	*0.00*	*0.13*	*9.71*
USR Type F Stone	57,800.00	TON	39,697	73,099	441,014	0	0	0	7,297	561,107
(Note: (3/4" to 1") ODOT 703.01 Size No. 68 clev e brkwtr 20/ton)										
			1.61	*6.59*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.49*
USR Haul from Sandusky	57,800.00	TON	92,788	381,008	0	0	0	0	16,829	490,625

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
(Note: 2400 tons per trip, 24 hrs per trip)										
			2.55	*8.36*	*33.35*	*0.00*			*0.46*	*44.72*
Type H	**33,500.00**	**TON**	**85,459**	**279,943**	**1,117,225**	**0**	**0**	**0**	**15,568**	**1,498,195**
			0.95	*1.76*	*33.35*	*0.00*	*0.00*	*0.00*	*0.17*	*36.23*
USR Type H Stone	33,500.00	TON	31,680	59,117	1,117,225	0	0	0	5,814	1,213,836
(Note: (6" - 18") ODOT 703.19B Type C)										
			1.61	*6.59*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.49*
USR Haul from Sandusky	33,500.00	TON	53,779	220,827	0	0	0	0	9,754	284,359
(Note: 2400 tons per trip, 24 hrs per trip)										
			15,454.76	*22,478.11*	*3,516.80*	*0.00*			*2,769.56*	*44,219.23*
Weir and Walkway	**1.00**	**EA**	**15,455**	**22,478**	**3,517**	**0**	**0**	**0**	**2,770**	**44,219**
(Note: Quantities obtained from Dike 10b IGE dated June 1996)										
			14,260.32	*22,329.63*	*1,420.50*	*0.00*			*2,607.48*	*40,617.92*
Wier	**1.00**	**EA**	**14,260**	**22,330**	**1,421**	**0**	**0**	**0**	**2,607**	**40,618**
			15.84	*24.81*	*0.70*	*0.00*	*0.00*	*0.00*	*2.90*	*44.25*
MIL 031104300150 C.I.P. concrete forms, footing, continuous wall, plywood, 4 use, includes erecting, bracing, stripping and cleaning	300.00	SFC	4,753	7,443	210	0	0	0	869	13,276
			2,376.72	*3,721.60*	*541.50*	*0.00*	*0.00*	*0.00*	*434.58*	*7,074.40*
MIL 032106000700 Reinforcing steel, in place, walls, #3 to #7, A615, grade 60	1.00	TON	2,377	3,722	542	0	0	0	435	7,074
			396.12	*620.27*	*0.00*	*0.00*	*0.00*	*0.00*	*72.43*	*1,088.82*
USR 033107005400 Structural concrete, placing, walls, with crane and bucket, 15" thick, includes vibrating, excludes material	6.00	CY	2,377	3,722	0	0	0	0	435	6,533
			0.00	*0.00*	*110.00*	*0.00*	*0.00*	*0.00*	*0.00*	*110.00*
MIL 033102200300 Structural concrete, ready mix, normal weight, 4000 PSI, includes material only	6.00	CY	0	0	660	0	0	0	0	660
			15.84	*24.81*	*0.03*	*0.00*	*0.00*	*0.00*	*2.90*	*43.58*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
MIL 033503500010 Concrete finishing, walls, includes breaking ties and patching voids	300.00	SF	4,753	7,443	9	0	0	0	869	13,075
			1,194.44	*148.49*	*2,096.30*	*0.00*			*162.08*	*3,601.30*
Walkway, Railing and Ladder	**1.00**	**EA**	**1,194**	**148**	**2,096**	**0**	**0**	**0**	**162**	**3,601**
			7.40	*0.77*	*13.92*	*0.00*	*0.00*	*0.00*	*1.00*	*23.10*
RSM 055207000020 Railing, pipe, aluminum, satin finish, 2 rails, 1-1/4" dia	20.00	LF	148	15	278	0	0	0	20	462
			1.97	*0.21*	*8.86*	*0.00*	*0.00*	*0.00*	*0.27*	*11.31*
MIL 055303400694 Floor grating, steel, galvanized, 1-1/4" x 3/16" bearing bars @ 15/16" O.C., cross bars @ 4" O.C., 9.1 #/S.F., up to 300 S.F.	100.00	SF	197	21	886	0	0	0	27	1,131
			24.70	*3.77*	*4.40*	*0.00*	*0.00*	*0.00*	*3.35*	*36.22*
MIL 051204400672 Channel framing, structural steel, field fabricated, C8x11.5, incl cutting & welding	20.00	LF	494	75	88	0	0	0	67	724
			23.68	*2.47*	*56.26*	*0.00*	*0.00*	*0.00*	*3.21*	*85.62*
MIL 055145000020 Ladder, steel, 20" W, bolted to concrete, incl cage	15.00	VLF	355	37	844	0	0	0	48	1,284
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*35,000.00*
Fish Removal	**1.00**	**EA**	**0**	**0**	**0**	**0**	**35,000**	**0**	**0**	**35,000**
USR Fish Removal	1.00	LS	0	0	0	0	35,000	0	0	35,000
(Note: From Cleveland 10 B.)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*1,250.00*
Outfall Relocation	**2,670.00**	**LF**	**0**	**0**	**0**	**0**	**3,337,500**	**0**	**0**	**3,337,500**
(Note: Relocated First Energy Outfall 002 & 003. Outfalls to be relocated through the west arm of the first phase of the CDF. No sizes given. Assume the East 20 th street design from Cleveland 10b CDF.)										
			0.00	*0.00*	*0.00*	*0.00*	*1,250.00*	*0.00*	*0.00*	*1,250.00*
USR Outfall Relocation	2,670.00	LF	0	0	0	0	3,337,500	0	0	3,337,500
(Note: From Cleveland CDF 10B E20th Street outfall -171" x 110" Corr Steel Pipe Arch. Low Bidders unit Cost updated by ENR to current date. Unit price include OH & Profit. Leave assigned contractor as - (Unassigned).)										

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*16.45*
Geotextile	**7,600.00**	**SY**	**0**	**0**	**0**	**0**	**0**	**125,000**	**0**	**125,000**
			0.00	*0.00*	*0.00*	*0.00*	*0.00*	*5.00*	*0.00*	*5.00*
USR Geotextile	25,000.00	SY	0	0	0	0	0	125,000	0	125,000
(Note: Estimaors judgement from past projects.)										
Phase 3	**1.00**	**LS**	**5,047,215**	**8,796,053**	**47,661,916**	**15,600**	**7,267,823**	**0**	**917,603**	**69,706,209**
(Note: Eastern section of entire CDF area from the West end of the Marina to the First Energy Outfall. Stone prices from Cleveland DMMP 2006 Estimates from Jim Dean.)										
			440,486.88	*446,829.10*	*31,600.00*	*15,600.00*			*77,624.11*	*1,012,140.09*
General Conditions	**1.00**	**EA**	**440,487**	**446,829**	**31,600**	**15,600**	**0**	**0**	**77,624**	**1,012,140**
			14,526.72	*0.00*	*14,400.00*	*15,600.00*			*2,488.74*	*47,015.46*
Temporary Office	**1.00**	**EA**	**14,527**	**0**	**14,400**	**15,600**	**0**	**0**	**2,489**	**47,015**
			0.00	*0.00*	*300.00*	*0.00*	*0.00*	*0.00*	*0.00*	*300.00*
AF 015205000550 Office Trailer, furnished, rent per month, 50' x 12', excl. hookups	36.00	MO	0	0	10,800	0	0	0	0	10,800
			0.00	*0.00*	*0.00*	*400.00*	*0.00*	*0.00*	*0.00*	*400.00*
USR Utility Costs	36.00	MO	0	0	0	14,400	0	0	0	14,400
(Note: Include Electric, Phone, Fax and Supplies)										
USR Mob and Demob Office Trailer	1.00	LS	0	0	0	1,200	0	0	0	1,200
			403.52	*0.00*	*100.00*	*0.00*	*0.00*	*0.00*	*69.13*	*572.65*
USR Janitorial	36.00	MO	14,527	0	3,600	0	0	0	2,489	20,615
Submittals	**1.00**	**LS**	**18,683**	**0**	**10,000**	**0**	**0**	**0**	**3,419**	**32,102**
USR Reproduction and Mail	1.00	LS	0	0	10,000	0	0	0	0	10,000
			622.76	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*113.97*	*736.73*
USR Initial Project Submittals	30.00	DAY	18,683	0	0	0	0	0	3,419	22,102
Mob and Demob	**1.00**	**LS**	**44,772**	**128,393**	**0**	**0**	**0**	**0**	**8,196**	**181,361**
(Note: Assume 3 days initial mob + 2 days demob year 1 + 2 days mob year 2 + 2 days demob year 2 + year 3 (11 days @ 12 hrs/day))										
			144.48	*593.27*	*0.00*	*0.00*	*0.00*	*0.00*	*26.20*	*763.95*
USR 1 tug + 4 barges + 1 Eng + 1 Oper + 2 Tug Workers	132.00	HR	19,071	78,311	0	0	0	0	3,459	100,841
			194.70	*379.40*	*0.00*	*0.00*	*0.00*	*0.00*	*35.89*	*609.99*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
USR 1 Spud Barge + 1 Crane + 1 tug + 2 Oper + 2 Deck	132.00	HR	25,700	50,081	0	0	0	0	4,737	80,519
			362,505.60	*318,436.58*	*7,200.00*	*0.00*			*63,520.00*	*751,662.19*
Quality Control On-Site	**1.00**	**EA**	**362,506**	**318,437**	**7,200**	**0**	**0**	**0**	**63,520**	**751,662**
			10,069.60	*8,845.46*	*200.00*	*0.00*	*0.00*	*0.00*	*1,764.44*	*20,879.51*
USR Quality Control	36.00	MO	362,506	318,437	7,200	0	0	0	63,520	751,662
			1,133.09	*2,054.97*	*11,753.90*	*0.00*			*206.62*	*16,109.91*
PZC 13 Combi-wall	**4,052.00**	**LF**	**4,591,273**	**8,326,746**	**47,626,799**	**0**	**3,895,323**	**0**	**837,209**	**65,277,350**
(Note: First phase Combi-Wall approx.2887 lf Beam - W40 x 215 @ 73.45" (6.12') centers @ 68 feet long. Attached to the beams are connnectors welded to the beam for the PZC13 to insert into. PZC 13 @ 90 foot lengths. Anticipate that the sheet pile wall will be constructed after the west end of the breakwater is out of the water. Fill material should be available to be placed out to the location and as the wall is built the equipment should be able to be driven out onto the pier similar to the Chicago Shoreline Beach Piers.)										
			6.15	*6.86*	*254.40*	*0.00*			*1.12*	*268.54*
C King Pile (Beam)	**90,044.44**	**LF**	**553,869**	**617,791**	**22,907,249**	**0**	**0**	**0**	**101,276**	**24,180,185**
(Note: Includes BBS-M and BBS-F King piles are 68 feet in length. Lengths are on the high end for transportation purposes. From Civil/Structural Design assume that the lengths can be made and delivered without any splicing required at this point in the study.)										
			0.00	*0.00*	*2,165.00*	*0.00*	*0.00*	*0.00*	*0.00*	*2,165.00*
USR Material Price King Pile & connectors	10,580.72	TON	0	0	22,907,249	0	0	0	0	22,907,249
(Note: Connectors welded to pile.)										
			6.15	*6.86*	*0.00*	*0.00*	*0.00*	*0.00*	*1.12*	*14.14*
USR King pile installation	90,044.44	LF	553,869	617,791	0	0	0	0	101,276	1,272,936
(Note: Say 1 pile at 66 ft per hour due to tolerances.)										
			172.75	*192.69*	*2,035.00*	*0.00*			*31.59*	*2,432.03*
C PZC 13	**7,913.78**	**TON**	**1,367,130**	**1,524,911**	**16,104,536**	**0**	**0**	**0**	**249,983**	**19,246,560**
(Note: SSP piles are 125-140 feet in length. Lengths are on the high end for transportation purposes. From Civil/Structural Design assume that the lengths can be made and delivered without any splicing required at this point in the study.)										
			172.75	*192.69*	*0.00*	*0.00*	*0.00*	*0.00*	*31.59*	*397.03*
USR Steel Sheet Pile Installation	7,913.78	TON	1,367,130	1,524,911	0	0	0	0	249,983	3,142,024
(Note: 125 -140 foot sheets approx 2 ft wide @ say 2.0 sheets per hour = 250-280 sf/hr Reduce crew output due to need to thread in SSP at both sides and tight tolerances.)										
			0.00	*0.00*	*2,035.00*	*0.00*	*0.00*	*0.00*	*0.00*	*2,035.00*
USR Material Price SSP	7,913.78	TON	0	0	16,104,536	0	0	0	0	16,104,536
			1,408.84	*1,567.69*	*6,500.00*	*0.00*			*256.34*	*9,732.87*
C Tie Rods	**331.23**	**EA**	**466,656**	**519,271**	**2,153,020**	**0**	**0**	**0**	**84,910**	**3,223,856**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			0.87	*0.96*	*4.00*	*0.00*	*0.00*	*0.00*	*0.16*	*5.99*
USR Wale & Tie Rod installation	538,254.94	LB	466,656	519,271	2,153,020	0	0	0	84,910	3,223,856
(Note: Reviewed the Chicago Shoreline beach job and price quote for wales @ $1.38/lb. Update due to current rates Use $2.00/lb ADJUST PRICE OF TIE RODS (DOUBLE THAT OF WALES).)										
			0.87	*0.96*	*2.00*	*0.00*			*0.16*	*3.99*
C Wales	**940,064.00**	**LB**	**815,015**	**906,908**	**1,880,128**	**0**	**0**	**0**	**148,295**	**3,750,347**
			0.87	*0.96*	*2.00*	*0.00*	*0.00*	*0.00*	*0.16*	*3.99*
USR Wale & Tie Rod installation	940,064.00	LB	815,015	906,908	1,880,128	0	0	0	148,295	3,750,347
(Note: Reviewed the Chicago Shoreline beach job and price quote for wales @ $1.38/lb. Update due to current rates Use $2.00/lb)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*432.60*
C Concrete Cap	**9,004.44**	**CY**	**0**	**0**	**0**	**0**	**3,895,323**	**0**	**0**	**3,895,323**
			0.00	*0.00*	*0.00*	*0.00*	*412.00*	*0.00*	*0.00*	*412.00*
USR Concrete Cap	9,454.67	CY	0	0	0	0	3,895,323	0	0	3,895,323
(Note: From Chicago Shoreline 40-41 beach estimate approx. $400/cy Updated using ENR June 08 - June 07 = 1.03 = $412/cy (includes reinforcing and formwork). Add 5% to Qty for waste. Leave contractor unassigned as bid abstract price includes OH & Profit.)										
			2.31	*7.92*	*7.63*	*0.00*			*0.42*	*18.29*
Granular Fill	**600,506.73**	**TON**	**1,388,603**	**4,757,866**	**4,581,866**	**0**	**0**	**0**	**252,745**	**10,981,081**
(Note: Use Type D material.)										
			0.71	*1.33*	*7.63*	*0.00*	*0.00*	*0.00*	*0.13*	*9.80*
USR Type D Stone	600,506.73	TON	424,590	799,422	4,581,866	0	0	0	77,906	5,883,784
(Note: (4" Minus) ODOT 703.19A Crushed Ag clev e brkwtr 30/ton)										
			1.61	*6.59*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.49*
USR Haul from Sandusky	600,506.73	TON	964,013	3,958,445	0	0	0	0	174,839	5,097,297
(Note: 2400 tons per trip, 24 hrs per trip)										
			15,454.76	*22,478.11*	*3,516.80*	*0.00*			*2,769.56*	*44,219.23*
Weir and Walkway	**1.00**	**EA**	**15,455**	**22,478**	**3,517**	**0**	**0**	**0**	**2,770**	**44,219**
(Note: Quantities obtained from Dike 10b IGE dated June 1996)										
			14,260.32	*22,329.63*	*1,420.50*	*0.00*			*2,607.48*	*40,617.92*
Wier	**1.00**	**EA**	**14,260**	**22,330**	**1,421**	**0**	**0**	**0**	**2,607**	**40,618**
			15.84	*24.81*	*0.70*	*0.00*	*0.00*	*0.00*	*2.90*	*44.25*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
MIL 031104300150 C.I.P. concrete forms, footing, continuous wall, plywood, 4 use, includes erecting, bracing, stripping and cleaning	300.00	SFC	4,753	7,443	210	0	0	0	869	13,276
			2,376.72	*3,721.60*	*541.50*	*0.00*	*0.00*	*0.00*	*434.58*	*7,074.40*
MIL 032106000700 Reinforcing steel, in place, walls, #3 to #7, A615, grade 60	1.00	TON	2,377	3,722	542	0	0	0	435	7,074
			396.12	*620.27*	*0.00*	*0.00*	*0.00*	*0.00*	*72.43*	*1,088.82*
USR 033107005400 Structural concrete, placing, walls, with crane and bucket, 15" thick, includes vibrating, excludes material	6.00	CY	2,377	3,722	0	0	0	0	435	6,533
			0.00	*0.00*	*110.00*	*0.00*	*0.00*	*0.00*	*0.00*	*110.00*
MIL 033102200300 Structural concrete, ready mix, normal weight, 4000 PSI, includes material only	6.00	CY	0	0	660	0	0	0	0	660
			15.84	*24.81*	*0.03*	*0.00*	*0.00*	*0.00*	*2.90*	*43.58*
MIL 033503500010 Concrete finishing, walls, includes breaking ties and patching voids	300.00	SF	4,753	7,443	9	0	0	0	869	13,075
			1,194.44	*148.49*	*2,096.30*	*0.00*			*162.08*	*3,601.30*
Walkway, Railing and Ladder	**1.00**	**EA**	**1,194**	**148**	**2,096**	**0**	**0**	**0**	**162**	**3,601**
			7.40	*0.77*	*13.92*	*0.00*	*0.00*	*0.00*	*1.00*	*23.10*
RSM 055207000020 Railing, pipe, aluminum, satin finish, 2 rails, 1-1/4" dia	20.00	LF	148	15	278	0	0	0	20	462
			1.97	*0.21*	*8.86*	*0.00*	*0.00*	*0.00*	*0.27*	*11.31*
MIL 055303400694 Floor grating, steel, galvanized, 1-1/4" x 3/16" bearing bars @ 15/16" O.C., cross bars @ 4" O.C., 9.1 #/S.F., up to 300 S.F.	100.00	SF	197	21	886	0	0	0	27	1,131
			24.70	*3.77*	*4.40*	*0.00*	*0.00*	*0.00*	*3.35*	*36.22*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
MIL 051204400672 Channel framing, structural steel, field fabricated, C8x11.5, incl cutting & welding	20.00	LF	494	75	88	0	0	0	67	724
			23.68	*2.47*	*56.26*	*0.00*	*0.00*	*0.00*	*3.21*	*85.62*
MIL 055145000020 Ladder, steel, 20" W, bolted to concrete, incl cage	15.00	VLF	355	37	844	0	0	0	48	1,284
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*35,000.00*
Fish Removal	**1.00**	**EA**	**0**	**0**	**0**	**0**	**35,000**	**0**	**0**	**35,000**
USR Fish Removal	1.00	LS	0	0	0	0	35,000	0	0	35,000
(Note: From Cleveland 10 B.)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*1,250.00*
Outfall Relocation	**2,670.00**	**LF**	**0**	**0**	**0**	**0**	**3,337,500**	**0**	**0**	**3,337,500**
(Note: Relocated First Energy Outfall 002 & 003. Outfalls to be relocated through the west arm of the first phase of the CDF. No sizes given. Assume the East 20 th street design from Cleveland 10b CDF.)										
			0.00	*0.00*	*0.00*	*0.00*	*1,250.00*	*0.00*	*0.00*	*1,250.00*
USR Outfall Relocation	2,670.00	LF	0	0	0	0	3,337,500	0	0	3,337,500
(Note: From Cleveland CDF 10B E20th Street outfall -171" x 110" Corr Steel Pipe Arch. Low Bidders unit Cost updated by ENR to current date. Unit price include OH & Profit. Leave assigned contractor as - (Unassigned).)										
Phase 4	**1.00**	**LS**	**1,027,617**	**2,448,102**	**13,067,370**	**0**	**1,051,100**	**0**	**187,726**	**17,781,915**
(Note: Phase 4 is placing stone and or onterlocking concrete mat and building berms out of dredge material. Stone items taken from CDFconstruction projects.)										
			0.07	*0.15*	*0.00*	*0.00*			*0.01*	*15.61*
Berms	**68,300.00**	**CY**	**4,622**	**9,920**	**0**	**0**	**1,051,100**	**0**	**845**	**1,066,486**
(Note: It is assumed by the time that the dredge material is at the level that the stone protection (phase 4) that equipment will be able to go onto the deposited dredge material and build the berms from deposited material onstite. This item also include removal of berm material for construction of stone protection.)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*11.50*
Initial Raising	**52,300.00**	**CY**	**0**	**0**	**0**	**0**	**601,450**	**0**	**0**	**601,450**
			0.00	*0.00*	*0.00*	*0.00*	*11.50*	*0.00*	*0.00*	*11.50*
USR Borrow area Excavation & Berm Construction	52,300.00	CY	0	0	0	0	601,450	0	0	601,450
(Note: Leave contractor unassigned as this is from a bid abstract - TAB Construction Dike 12 Berm Raising.)										
			0.00	*0.00*	*0.00*	*0.00*			*0.00*	*11.50*
Final Raising	**39,100.00**	**CY**	**0**	**0**	**0**	**0**	**449,650**	**0**	**0**	**449,650**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			0.00	*0.00*	*0.00*	*0.00*	*11.50*	*0.00*	*0.00*	*11.50*
USR Borrow area Excavation & Berm Construction	39,100.00	CY	0	0	0	0	449,650	0	0	449,650
(Note: Leave contractor unassigned as this is from a bid abstract - TAB Construction Dike 12 Berm Raising.)										
			0.29	*0.62*	*0.00*	*0.00*			*0.05*	*0.96*
Berm Removal	**16,000.00**	**CY**	**4,622**	**9,920**	**0**	**0**	**0**	**0**	**845**	**15,386**
(Note: Berm raising will have to be overbuilt and then some material will be removed to place the stone protection. This item is for removing the berm on the lakeward side for construction of the stone protection. Assume material to be side cast toward the center of the dike. Detail Item from cost book - add contractor to item)										
			0.29	*0.62*	*0.00*	*0.00*	*0.00*	*0.00*	*0.05*	*0.96*
RSM 312316420300 Excavating, bulk bank measure, 3 C.Y. capacity = 160 C.Y./hour, backhoe, hydraulic, crawler mounted, excluding truck loading	16,000.00	BCY	4,622	9,920	0	0	0	0	845	15,386
			3.08	*9.47*	*52.50*	*0.00*			*0.56*	*65.61*
Type A	**166,700.00**	**TON**	**513,492**	**1,578,002**	**8,751,750**	**0**	**0**	**0**	**93,860**	**10,937,103**
			1.48	*2.87*	*52.50*	*0.00*	*0.00*	*0.00*	*0.27*	*57.12*
USR Type A Armor Stone (5 ton to 10 ton)	166,700.00	TON	245,883	479,142	8,751,750	0	0	0	45,325	9,522,099
			1.61	*6.59*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.49*
USR Haul from Sandusky	166,700.00	TON	267,609	1,098,860	0	0	0	0	48,535	1,415,004
(Note: 2400 tons per cycle, 24 hrs per cycle)										
			2.75	*8.82*	*48.00*	*0.00*			*0.50*	*60.08*
Type B	**62,500.00**	**TON**	**171,914**	**551,477**	**3,000,000**	**0**	**0**	**0**	**31,392**	**3,754,783**
			1.15	*2.23*	*48.00*	*0.00*	*0.00*	*0.00*	*0.21*	*51.59*
USR Type B Stone (600 lb to 2000 lb) Placed for CDF	62,500.00	TON	71,581	139,487	3,000,000	0	0	0	13,195	3,224,263
			1.61	*6.59*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.49*
USR Haul from Sandusky	62,500.00	TON	100,333	411,990	0	0	0	0	18,197	530,520
(Note: 2400 tons per cycle, 24 hrs per cycle)										
			2.37	*8.08*	*24.50*	*0.00*			*0.43*	*35.38*
Type E	**30,600.00**	**TON**	**72,487**	**247,239**	**749,700**	**0**	**0**	**0**	**13,216**	**1,082,642**
			0.76	*1.49*	*24.50*	*0.00*	*0.00*	*0.00*	*0.14*	*26.89*
USR Type C and E Stone	30,600.00	TON	23,364	45,529	749,700	0	0	0	4,307	822,899
(Note: (3 in to 6 in) ODOT 703.19B Type D clev e brkwtr 32/ton)										

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	Bid Abstract	Estimators Jud	DirectMU	DirectCost
			1.61	*6.59*	*0.00*	*0.00*	*0.00*	*0.00*	*0.29*	*8.49*
USR Haul from Sandusky	30,600.00	TON	49,123	201,710	0	0	0	0	8,909	259,743
(Note: 2400 tons per trip, 24 hrs per trip)										
			1.17	*2.28*	*1.20*	*0.00*			*0.22*	*4.86*
Geotextile	**27,000.00**	**SY**	**31,541**	**61,464**	**32,400**	**0**	**0**	**0**	**5,814**	**131,219**
			0.97	*1.90*	*1.00*	*0.00*	*0.00*	*0.00*	*0.18*	*4.05*
USR Geotextile	32,400.00	SY	31,541	61,464	32,400	0	0	0	5,814	131,219
(Note: 50 ft x 15 ft / 9 sf/sy = 83 sy Section. Say 1/2 hr to place a section. 83 sy x 2 = 164 sy hr. Use 200 sy/hr. Includes overlap)										
			18.84	*0.00*	*43.03*	*0.00*			*3.44*	*65.30*
Concrete Mat	**12,400.00**	**SY**	**233,561**	**0**	**533,520**	**0**	**0**	**0**	**42,600**	**809,681**
			3.41	*0.00*	*7.80*	*0.00*	*0.00*	*0.00*	*0.62*	*11.84*
RSM 321413130020 Interlocking precast concrete unit paving, "V" blocks for retaining soil	68,400.00	SF	233,561	0	533,520	0	0	0	42,600	809,681

Tab H
Summary Geotechnical Narrative for Preliminary Cellular Wall Design

CLEVELAND NEW CDF
E55 AALTERNATIVE SITE
CLEVELAND, OHIO

GEOTECHNICAL NARRATIVE OF PRELIMINARY CELLULAR WALL DESIGN

OCTOBER 2008

A. EXISTING SUBSURFACE INFORMATION

The CDF Alternative Site referenced in this narrative is referred to as the E55 Site (Figure 1).

Existing subsurface explorations near this site are from the Cleveland East Breakwater Rehabilitation Project which were drilled in 1978 and the Burke East proposed disposal site drilled in 1991. Figure 1 shows the location of these explorations with respect to the proposed CDF location.

B. SUBSURFACE CONDITIONS

Figure 2 shows a Geologic Profile which is composed from the borings from the eastern edge of the Burke East proposed disposal site which is adjacent to the western proposed CDF cell wall and along the Cleveland East Breakwater which is north of the proposed CDF cell wall. These explorations show that the lake bottom consists of very soft Organic Clay (OH) and Silt (OL) which has a thickness of about 10 to 15 feet and extends to about elevation 531 (IGLD, 1985). Below these very soft deposits are soft to medium stiff clay deposits (CL) which extends down to Elevation 475 (IGLD, 1985). The existing borings does not reveal the depth of bedrock or very hard bearing material. In order to find the depth of bearing material and subsurface material characteristics within the proposed CDF location a subsurface exploration program will be completed in the spring of 2009.

C. PRELIMINARY GEOTECHNICAL SOIL PARAMETERS

Using existing subsurface information preliminary soil parameters were developed for use in performing a preliminary structural design analysis of the cellular containment walls and bearing capacity analysis. Table 1 below summarizes these soil design parameters. Final soil design parameters will be developed after the Spring 2009 drilling and testing program is completed.

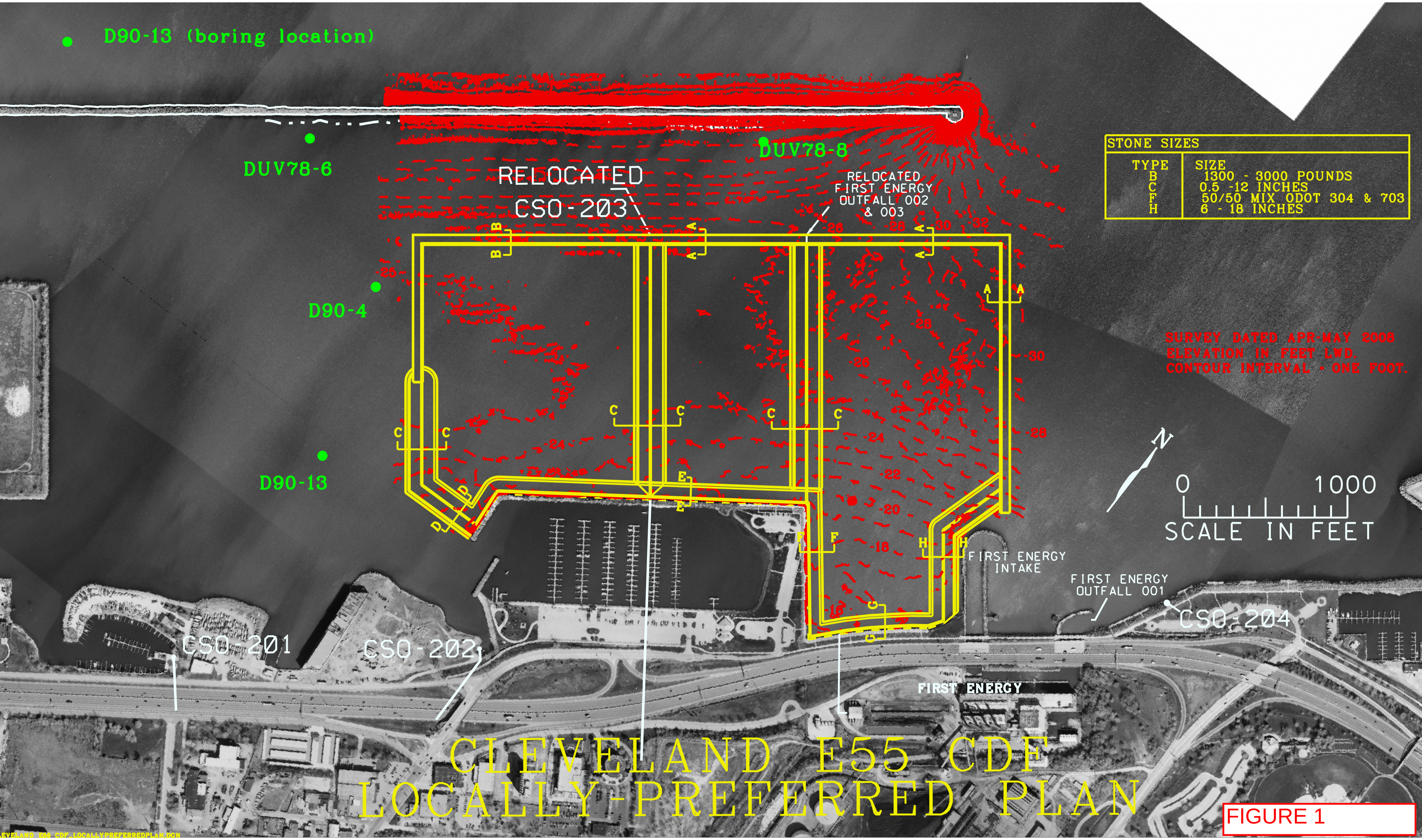
Table 1 - Cleveland New CDF Preliminary Soil Design Parameters

Material Type	**Elevation Range**	**Saturated Unit Weight**	**Undrained Strength**		**Drained Strength**	
			C	**ϕ**	**C′**	**ϕ'**
Organic Silt (OH)	Lake Bottom to El.531.0	100	40	0	0	28
Soft to Medium Stiff Clay (CL)	El 531.0 to El 475.0	122	200+ 44z	0	0	26

Z = Depth below stratum

D. GEOTECHNICAL BEARING CAPACITY ANALYSIS

Using the above preliminary soil design parameters a bearing capacity analysis was performed on the proposed cellular sheet pile structure to check the factor of safety (overturning) against bearing failure of the cellar structure. The analysis was performed in accordance with the guidance contained in EM 1110-2-2503. The referenced guidance recommends a minimum factor of safety of 3.0 against bearing failure. The bearing capacity computations are presented on the following calculation pages. Results of this analysis indicate that the cellular sheet pile would have to extend to a depth 115 feet below low water datum (El. 454.2) to obtain a suitable factor of safety against bearing failure.



STONE SIZES

TYPE	SIZE
B	1300 - 3000 POUNDS
C	0.5 -12 INCHES
F	50/50 MIX ODOT 304 & 703
H	6 - 18 INCHES

CLEVELAND E55 CDF
LOCALLY-PREFERRED PLAN

FIGURE 1

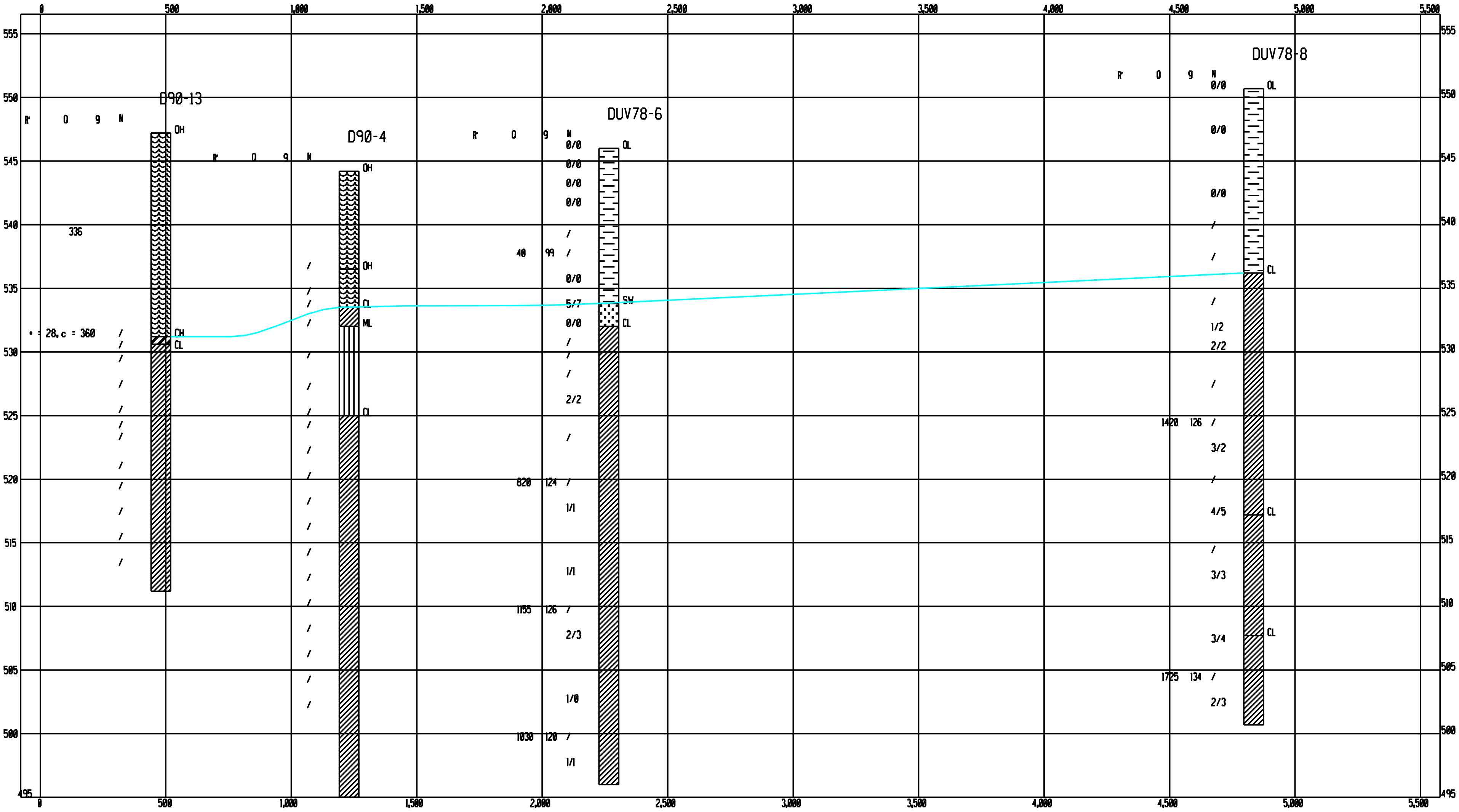

D90-13
D90-4
DUV78-6
DUV78-8
OH
CH
CL
ML
OL
SW
R O 9 N
336
• = 28, c = 360
40 99
820 124
1155 126
1030 120
1420 126
1725 134
0/0
5/7
2/2
1/1
2/3
1/0
1/2
3/2
4/5
3/3
3/4
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
5,500
555
550
545
540
535
530
525
520
515
510
505
500
495

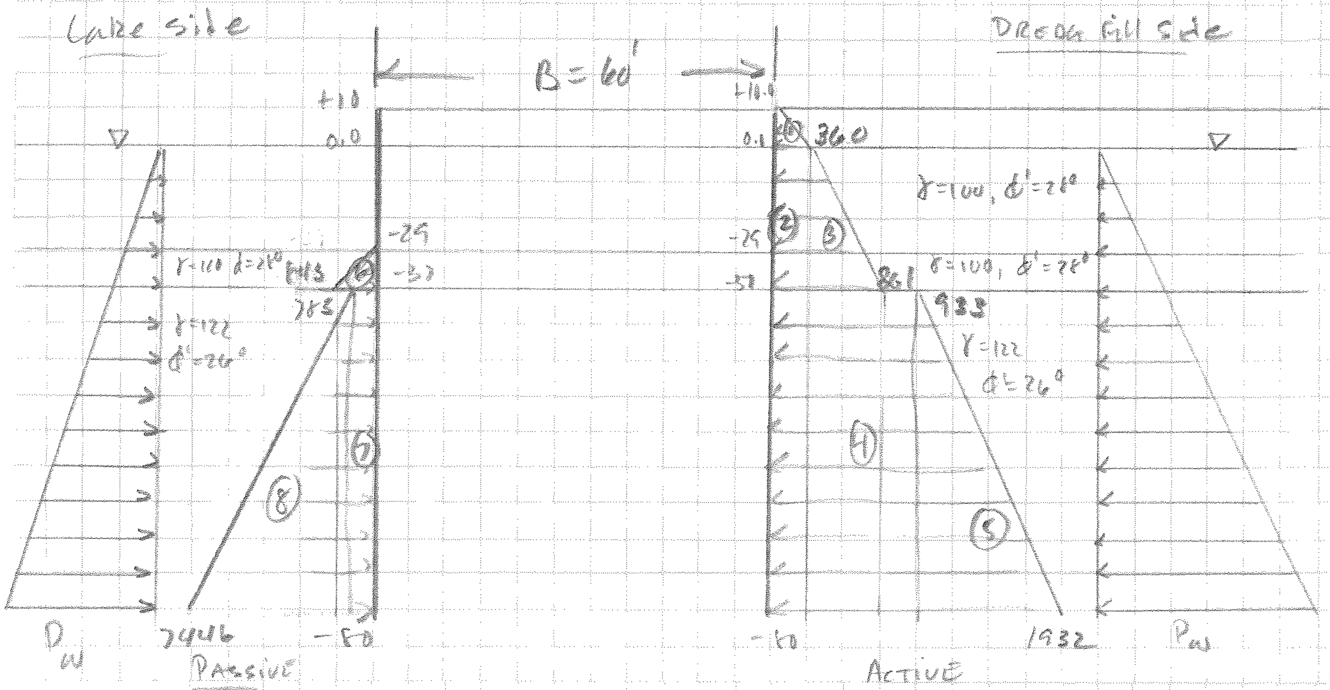
FIGURE 2

Page 1 of 2 pages.

Subject CLEELAND COF

Computation of BEARING CAPACITY CELL WALL

Computed by GL **Checked by** ________ **Date** AUG 2008



(1.) Find Net overturning Moment

(2.) Moment from Water Pressure Cancels as Pressure is the same on both Active & Passive sides

A.) ACTIVE PRESSURES (DREGE FILL SIDE)

+10 to 0.0' | $\phi' = 28^0$, $K_a = \tan^2(45 - \phi'/2) = 0.36$, $\gamma = 100 \text{ lb/ft}^3$

$\sigma_v = 100 \times 10' = 1{,}000 \text{ lb/ft}^2$

$\sigma_A = K_a \sigma_v = 0.36(1{,}000) = \underline{360 \text{ lb/ft}^2}$

0.0' to -37.0' | From muck lake bottom @ -29.0' to -37.0' assume Same Soil Properties as dredge fill

$\sigma_v = 1{,}000 + (100 - 62.4) \times 37 = 2{,}391 \text{ lb/ft}^2$

$\sigma_A = K_a \sigma_v = 0.36(2{,}391 \text{ lb/ft}^2) = \underline{861 \text{ lb/ft}^2}$

Subject Cleveland CDF
Computation of Bearing Capacity Cell Wall
Computed by
Checked by
Date AUG 2018

A.) Active Pressures (Con't)

-37.0' to -80.0' | $\gamma' = 122\ lb/ft^3$, $\phi' = 26^0$ (more clay)

$K_a = TAN^2(45 - \phi'/2) = TAN^2(45 - 26/2) = 0.39$

$\sigma_{v(-37)} = 2{,}391\ lb/ft^2$

$\sigma_{A_{-37}} = 0.39(2{,}391) = \underline{933}\ lb/ft^2$

$\sigma_{v_{-80}} = 2{,}391\ lb/ft^2 + (122 - 62.4)\,43_{ft} = 4{,}954\ lb/ft^2$

$\sigma_{A_{-80}} = 0.39(4{,}954) = \underline{1{,}932\ lb/ft^2}$

B. Passive Pressures (Lake side)

-29.0' to -37.0' | muck lake bottom to top of medium to stiff lacustine clay @ -37.0'

$\sigma_{v_{-37}} = (100 - 62.4) \times 8.0' = 301\ lb/ft^2$ $K_p = TAN^2(45' + \phi'/2)$

$K_p = TAN^2(45 + \frac{28}{2}) = 2.8$

$\sigma_{p_{-37}} = K_p\,\sigma_v = 2.8(301) = \underline{843}\ lb/ft^2$

-37.0' to -80.0' | $\phi' = 26^0$ $K_p = TAN^2(45 + \frac{26}{2}) = 2.6$

$\sigma_{v_{-80}} = 301 + (122 - 62.4) \times 43_{ft} = 2{,}864\ lb/ft^2$

$\sigma_{p_{-80}} = K_p\,\sigma_v = 2.6(2864) = 7{,}446\ lb/ft^2$

Subject CLEVELAND CDF

Computation of BEARING CAPACITY CELL WALL

Computed by [illegible] **Checked by** **Date** AUG 2008

B.) PASSIVE PRESSURE (CON'T)

AT -37.0 TOP OF MEDIUM STIFF CLAY

$K_p = 2.6$

$\sigma_v = 301 \, lb/ft^2$

$\sigma_p = K_p \sigma_v = 2.6(301) = 783 \, lb/ft^2$

C.) MOMENTS ACTIVE SIDE

AREA NO	FORCE	MOMENT ARM	MOMENT
①	$(360 \times 10)/2$ = 1,800 lbs	$80 + 10/3$ = 83.3 FT	149,940 FT-lb
②	360×80 = 28,800 lbs	$80/2$ = 40 FT	1,152,000 FT-lbs
③	$\frac{(861-360)}{2} \times 37$ FT = 9,269 lbs	43 FT $+ \frac{37}{3}$ = 55.3 FT	512,555 FT-lbs
④	933×43 = 40,119 lbs	$43/2$ = 21.5 FT	862,559 FT-lbs
⑤	$\frac{(1932-933)}{2} \times 43$ = 21,479 lbs	$43/3$ = 14.3 FT	307,150 FT-lbs

TOTAL ACTIVE MOMENT = 2,984,534 FT-lbs

Subject CLEVELAND CDF
Computation of BEARING CAPACITY CALCULATION
Computed by [illegible] **Checked by** **Date**

D.) MOMENTS PASSIVE SIDE

AREA	FORCE	MOMENT ARM	MOMENT
⑥	(843×8)/2 = 3,372 lbs	43 + 8/3 = 45.7 FT	153,988 FT-lbs
⑦	783 × 43 = 33,669 lbs	43/2 = 21.5 FT	723,884 FT-lbs
⑧	$\frac{(2446 - 783)\times 43}{2}$ = 143,255 lbs	43/3 = 14.3 FT	2,053,322 FT-lbs

TOTAL PASSIVE MOMENT = 2,931,194 FT-lbs

M, NET MOMENT $= M_A - M_p = 2{,}984{,}534 - 2{,}931{,}194$

$M = 53{,}340$ FT-lbs

E) BEARING CAPACITY FOS

$$FS = \frac{q_{ULT}}{\frac{W_{CELL}}{B} + \frac{6M}{B^2}}$$

Subject CLEVELAND CDF
Computation of BEARING CAPACITY CELL WALL
Computed by [illegible] **Checked by** **Date** Aug 2004

E) BEARING CAPACITY (CONT)

$Q_{ULT} = CN_c + \gamma D_f N_q$

$C = 320 + 17.5z$ (MEDIUM STIFF CLAY)

$D_f = 80' - 29.0 = 51.0'$

$\gamma = 122 \text{ lb/ft}^3$

For Strip Load $\phi = 0°$, $N_c = 5.7$, $N_q = 1.0$

$C = 320 + 17.5(80-37) = 1073 \text{ lb/ft}^2$

DEPTH - FT

$Q_{ULT} = \overset{6116}{1073 \times 5.7} + \overset{3040}{(122-62.4)\,51.0'}$

$Q_{ULT} = 9,156 \text{ lb/ft}^2$

$W_{CELL} = (\gamma_{\substack{MSF\\FILL}} \times 10_{FT}) \times 60_{FT} + (\gamma_{\substack{SAT\\FILL}} - 62.4)\, 29.0_{FT} \times 60_{FT}$
$+ (\gamma_{MUCK} - 62.4) \times 8.0_{FT} \times 60_{FT} + (\gamma_{\substack{SAT\\CLAY}} - 62.4) \times 43_{FT} \times 60_{FT}$

$W_{CELL} = (120)(10)(60) + (132-62.4) \times 29 \times 60$
$+ (100-62.4) \times 8.0 \times 60.0 + (122-62.4) \times 43.0 \times 60$

$W_{CELL} = 72{,}000 \text{ lbs} + 121{,}104 \text{ lbs} = 193{,}104$
$+ 18{,}048 + 153{,}768 = 364{,}920 \text{ lbs}$

Page 6 of 7 pages.

Subject CLEVELAND CDF

Computation of BEARING CAPACITY CELL WALLS

Computed by GL **Checked by** ______ **Date** AUG 2008

E.) BEARING CAPACITY (QULT)

$$FS = \frac{Q_{ULT}}{\frac{W}{B} + \frac{6M}{B^2}} = \frac{9{,}156\ \text{lb/ft}^2}{\frac{\overset{193,401}{364{,}520\ \text{lbs}}}{60\text{ft} \times \text{ft}} + \frac{6(53{,}340)}{60\text{ft}^2}}$$

$$FS = \frac{9156}{6082 + 89} = \frac{9{,}156}{3{,}312} = 1.48 < 3.0$$

Clay NO GOOD!

$$q_{ALLOW} = \frac{q_{net}}{FS}$$

$$q_{net} = q_{ULT} - \gamma D_f = CN_c = 1073 \times 5.7 = 6{,}116\ \text{lb/ft}^2$$

$$q_{ALLOW} = \frac{6{,}116}{3} = 2039\ \text{lb/ft}^2$$

$H = ?$ $B = 60\text{ft.}$

$$q_{APPLIED} = \frac{(132 - 62.4) \times H \times 60}{60} = 2039\ \text{lb/ft}^2$$

$$H = \frac{2039}{(132 - 62.4)} = 29.3\ \text{ft.}$$

Page 7 of 7 pages.

Subject Cleveland CDF

Computation of Bearing Capacity Cell Wall

Computed by KL **Checked by** **Date** [illegible]

Deepen Cell

$W_{Applied} = 72{,}000\,lbs + 121{,}104\,lbs = 193{,}104\,lbs$

$q_{Applied} = \dfrac{W_{Applied}}{B} = \dfrac{193{,}104\,lbs}{60\,ft} = 3{,}218\,lb/ft^2$

$q_{net} = 3.0\,q_{Applied} = 3.0(3{,}218\,lb/ft^2)$

$q_{net} = 9{,}654\,lb/ft^2 = cN_c$

$c = \dfrac{q_{net}}{N_c} = \dfrac{9{,}654}{(5.7)} = 1{,}694\,lb/ft^2$

What depth to get this strength?

$c = 320 + 17.5z = 1{,}694\,lb/ft^2$

$17.5z = 1{,}694 - 320$

$z = \dfrac{1694 - 320}{17.5} = 78.5\,ft$

Required Depth cell $= 78.5\,ft + 37\,ft = \underline{115\,ft.}$

APPENDIX K

HYDROLOGIC MODEL REPORT

ERDC/CHL Letter Report

Coastal and Hydraulics Laboratory

US Army Corps of Engineers®
Engineer Research and Development Center

Confined Disposal Facility Evaluation

Cleveland Harbor, Ohio Thermal Plume Transport Investigation

David J. Mark, Raymond S. Chapman, and Phu V. Luong

September 2008

ERDC/CHL Letter Report

Cleveland Harbor, Ohio Thermal Plume Transport Investigation

David J. Mark, Raymond S. Chapman, and Phu V. Luong

Coastal and Hydraulics Laboratory
U.S. Army Engineer Research and Development Center
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Prepared for U.S. Army Engineer District, Buffalo

Preface

The U.S. Army District, Buffalo (LRB) plans to construct a Confined Disposal Facility (CDF) within Cleveland Harbor. One potential site is located at the eastern entrance to the Harbor. However, this CDF site resides in close proximity to the cooling water intake and outfall structures servicing the First Energy Power Plant; concern exists that the planned CDF will change the circulation pattern in the Harbor area such that water discharge from the power plant will be subsequently drawn into the intake without adequate cooling.

Potential adverse impacts due to the proposed CDF, reported herein, were determined by examining changes in model-generated current circulation and thermal transport patterns. Modeling efforts concentrated on quantifying the change in circulation patterns with and without the CDF in place for storm and quiescent/non-storm conditions. For evaluating changes in the thermal plume transport, a two-month period of July and August 2002 was used as it reflects a period of limited wind-induced mixing.

This study was conducted for the CELRB. Mr. Joshua J. Feldman served as the study program manager and Mr. Michael C. Mohr served as the senior coastal engineer, as well as provided technical support and review for this study. Research and development activities for this study were conducted at the U.S. Army Engineer Research and Development Center (ERDC), Coastal and Hydraulics Laboratory (CHL), Vicksburg, MS. The study was performed by Mr. David J. Mark, Estuarine Engineering Branch (HF-EL), Dr. Raymond S. Chapman, Coastal Processes Branch (HF-C), and Dr. Phu V. Luong, HF-EL.

This investigation was performed under the direct supervision of Dr. Robert McAdory, Chief, HF-E, and Mr. Ty Wamsley, Chief, HF-C. General supervision was provided Mr. Bruce A. Ebersole, Chief, Flood and Storm Protection Division. In addition, Dr. William D. Martin served a Deputy Director, CHL, and Mr. Thomas W. Richardson served as its Director. COL Richard B. Jenkins was Commander and Executive Director of ERDC, and Dr. James R. Houston was Director.

Unit Conversion Factors

Multiply	By	To Obtain
feet	0.3048	meters
knots	0.5144444	meters per second
miles (nautical)	1,852	meters
miles (U.S. statute)	1,609.347	meters
miles per hour	0.44704	meters per second

1 Introduction

The U.S. Army District, Buffalo (LRB) plans to construct a Confined Disposal Facility (CDF) within Cleveland Harbor. One potential site is located at the eastern entrance to the Harbor. However, this site is located in close proximity to the cooling water intake and outfall structures servicing the First Energy Power Plant; concern exists that the planned CDF will change the circulation pattern in the Harbor area such that water discharge from the power plant will be subsequently drawn into the intake without adequate cooling. Figure 1-1 displays the existing harbor configuration and location of the power plant. To assess potential impacts from the planned construction, the LRB requested the U.S. Army Engineer Research and Development Center (ERDC), Coastal and Hydraulics Laboratory (CHL) to develop and apply numerical circulation and thermal transport models for making this determination.

Potential adverse impacts due to the proposed CDF, reported herein, were determined by examining changes in model-generated current circulation and thermal transport patterns. The initial modeling efforts concentrated on quantifying the change in circulation patterns with and without the CDF in place for storm and quiescent/non-storm conditions. For simulating quiescent conditions, a two-month period of July and August 2002 was chosen because summertime conditions reflect the worst-case scenario; less frequent passages of weather fronts and longer periods of relatively weaker winds induce less mixing of the Lake waters and plume than during other season. With the increased temperature of the ambient Lake water and less storm-induced mixing, the power plant’s heated discharge may not sufficiently cool, resulting in warmer water being drawn into the power plant.

Circulation of Lake Erie varies on a yearly, seasonal, and daily basis and is primarily driven by wind and atmospheric pressure, together with inflows from the Detroit River and outflows through the Niagara River. Other phenomena influencing circulation in the Lake include baroclinic gradients induced by air-lake temperature differences and river inflow/lake temperature differences. In order to replicate the primary processes that induce circulation, a nested modeling technique was selected and employed in this study. As such, one model was developed for the entire Lake and used to supply boundary-forcing data to a second model that highly resolves the Harbor proper.

The Lake-wide model includes wind forcing and river discharges at the Detroit, Niagara, Maumee, and Cuyahoga Rivers. As such, this model predicts the overall barotropic circulation within Lake Erie, and replicates the seiche oscillations induced by the passage of weather fronts.

The second model simulated hydrodynamic conditions and thermal transport of the heated water discharged from the power plant within the Harbor proper. The open-water boundary condition specified in this model is the water-surface elevations generated with the Lake-wide model. Furthermore, this model investigates two-dimensional (in plan) barotropic and baroclinic circulation. Future three-dimensional simulations can be conducted to investigate the vertical structure of the thermal plume and marina flushing should these tasks be deemed necessary.

This report contains four chapters, the first being the Introduction. Chapter 2 describes the Lake-wide modeling effort, including model development, calibration and validation, and evaluation of CDF configurations. Chapter 3 describes the thermal plume modeling. Chapter 4 summarizes the study findings. Appendices A and B describe the Lake-wide and Harbor models, whereas Appendix C contains comparisons of model-generated and measured water-surface elevations generated in the calibration and validation exercises of the Lake-wide model.

Figure 1-1. Existing Harbor configuration.

2 Lake-Wide Circulation Modeling

This chapter summarizes the circulation modeling conducted for Lake Erie, including Cleveland Harbor, using the ADCIRC long-wave hydrodynamic model. This component aims to characterize water levels and currents throughout the Harbor as it exists today and to predict any potential impacts that may result from constructing a Confined Disposal Facility (CDF). Comparing model-generated currents and water-surface elevations between pre- and post-construction conditions can provide insight, for example, into whether the CDF will reduce flushing of nearby marinas.

This chapter is composed of three sections, with the first describing the model development, which includes developing the numerical grid was well as in generating the forcing mechanisms used in driving the model. In the second section, the calibration and validation procedure is described, which ensures the model accurately depicts water-surface elevations and currents in the study area. The third section presents how the calibrated model was adapted for testing the three CDF configurations, together with comparing current patterns during storm and quiescent conditions.

Model Development

The ADCIRC numerical model, a large-domain, two-dimensional (2-D) depth-integrated finite-element hydrodynamic circulation model, was applied in this study to provide water level and depth-averaged current (circulation) information for Cleveland Harbor, Ohio. Described in Appendix A, the model solves the shallow-water equations in full nonlinear form and can be forced with time-varying water-surface elevation, wind, wave, and river inflow/outflow boundary conditions.

Figure 2-1 displays the grid developed for this study. As shown, the model domain encompasses the entire Lake, and includes the lower reaches of the Cuyahoga, Maumee, Detroit, and Niagara Rivers. Figure 2-2 displays the grid in the vicinity of Cleveland Harbor. Figure 2-3 displays an aerial photograph of the eastern Harbor, were the planned CDF will be constructed, and Figure 2-4 displays the grid

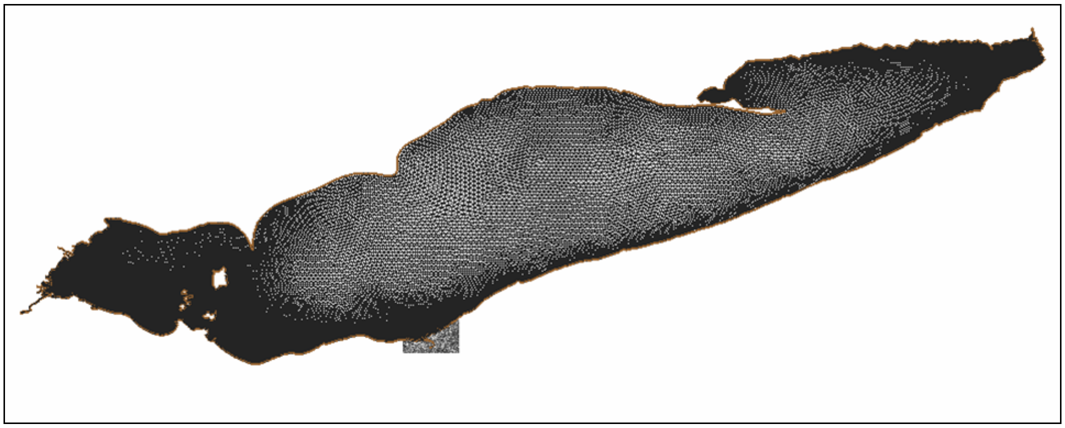


Figure 2-1. Lake Erie ADCIRC grid.

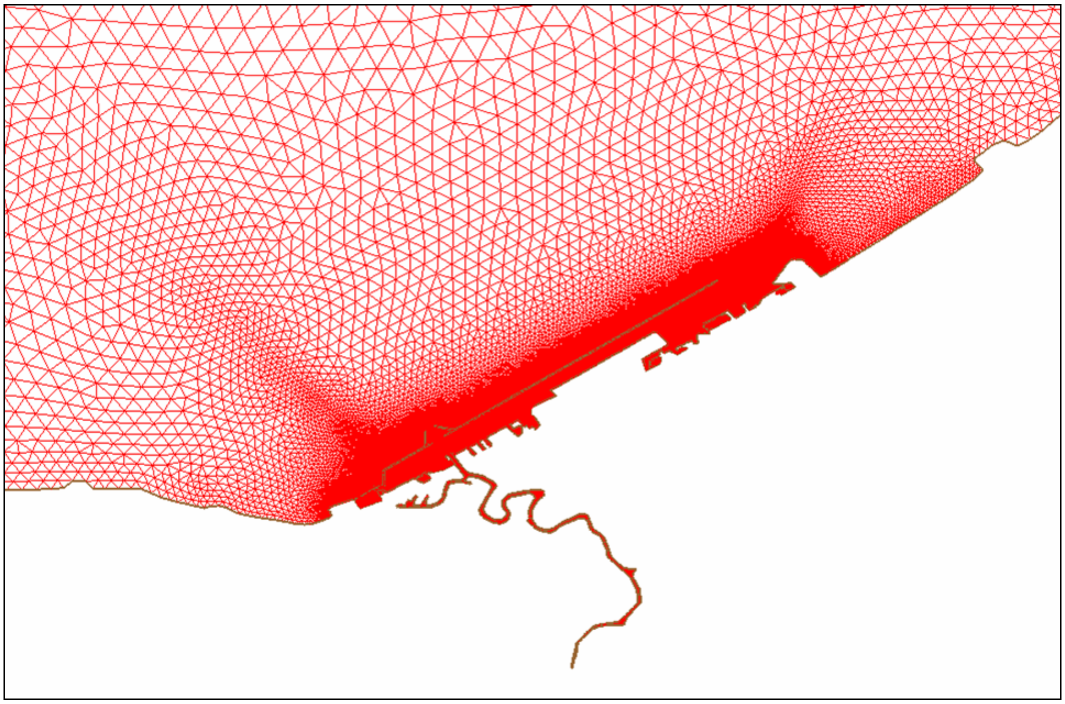


Figure 2-2. Lake Erie ADCIRC grid at Cleveland Harbor, Ohio.

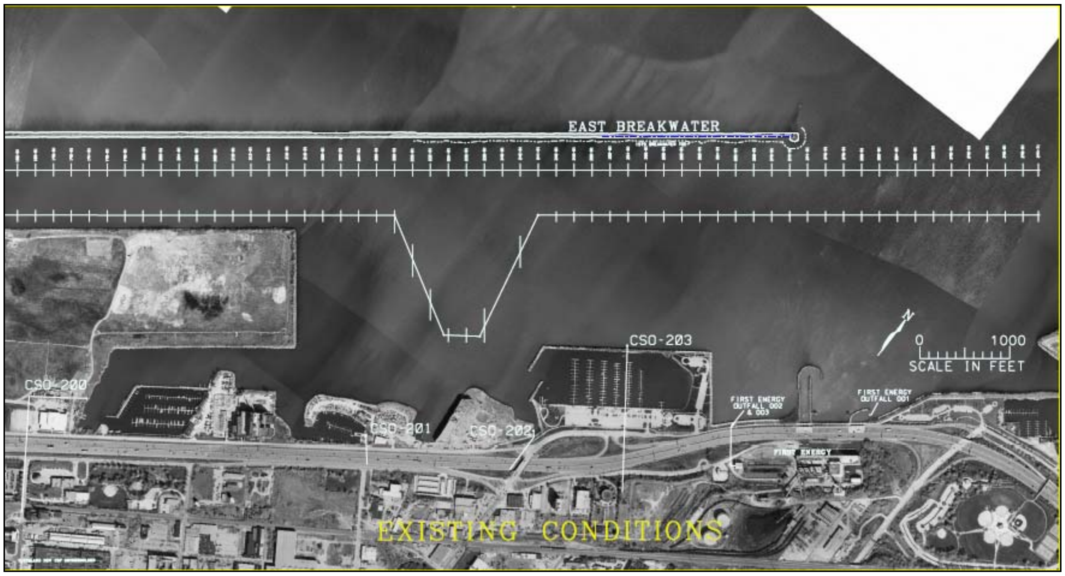


Figure 2-3. Base Harbor configuration.

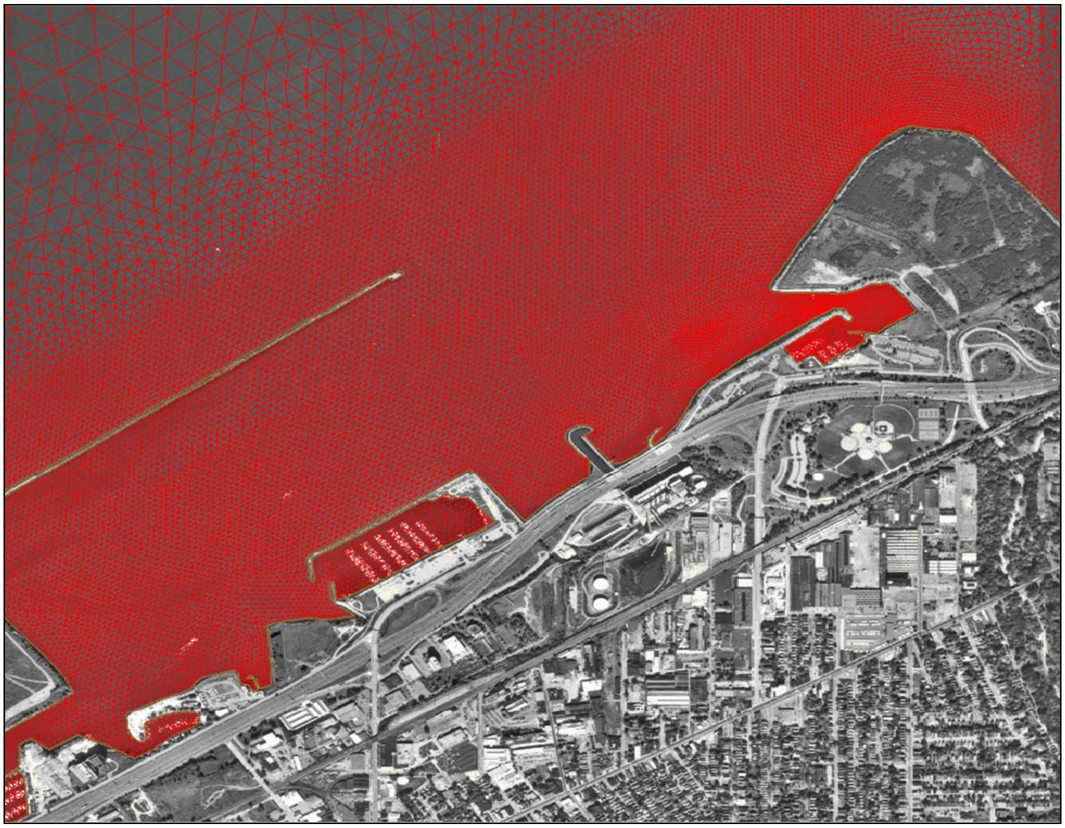


Figure 2-4. Lake Erie ADCIRC grid in project area.

of the same area. As shown in the above figures, the grid highly resolves the entire Harbor and its main, western, and eastern entrances, together with the lower reaches of the Cuyahoga River.

This existing-configuration or base grid consists of 95,255 nodes and 183,034 elements, of which 30,628 nodes and 62,038 elements resolve the Harbor. The largest elements reside in the central Lake basin, having nodal spacing of about 24 km, whereas the smallest elements resolve the western Harbor entrance, where their widths are approximately 15 m. For most of the Harbor, including the area of the proposed CDF, nodal spacings are approximately 20 m. Included in the grid are the power plant's outfall and intake structures.

The grid boundary along the Canadian shoreline was aligned with the shoreline shown on satellite imagery published by NaturalVue, which are digitally enhanced images taken by the Landsat satellite. These images have a 15-m resolution. For areas within the United States, shoreline positions are based on satellite imagery published by the U.S. National Geo-spatial Intelligence Agency (formerly the Defense Mapping Agency), and have a resolution of 5 meters. In the vicinity of Cleveland Harbor, U.S. Geological Survey Digital Orthographic Quarter-Quadrilateral (DOQQ) imagery was used in aligning the grid shoreline and its coastal structures. The DOQQs have a resolution of about 1 m.

Bathymetry specified in the grid were obtained from two sources. For Cleveland Harbor, bathymetry were extracted from contours and soundings residing in the U.S. National Oceanic and Atmospheric-published Electronic Nautical Chart. For the remaining regions outside of the Harbor, bathymetry data were extracted from the National Geophysical Data Center (NGDC) Coastal Relief Model database for Lake Erie as well as Lake St Clair. For both data sources depths are referenced to the International Great Lakes Datum 1985 (IGLD).

Forcing Data

Wind data were obtained from the National Oceanic and Atmospheric Administration's (NOAA) Great Lakes Environmental Research Laboratory (GLERL), and were generated as part of their Great Lakes Coastal Forecasting System (GLCFS). One component of the GLCFS is the generation of wind fields subsequently used in circulation and water level now-cast simulations. Hourly wind speeds and directions were extracted from GLCFS archives. These data are provided at 5-km intervals that encompass the entire Lake. Time periods for the extracted wind data include October and November, 2004, as well as Summer 2002.

Water level data for model calibration and validation consist of 12 gauges and were obtained from the U.S. National Ocean Service (NOS) and the Environment Canada-Canadian Marine Environment Data Service (CMEDS). River inflow data measured in the Detroit River were obtained from the U.S. Army District, Detroit, whereas flow rate data specified for the Cuyahoga, Niagara, and Maumee Rivers were obtained from the USGS stream flow web site.

Model Calibration and Validation

For the initial calibration, the time period of 13-19 October 2004 was selected for comparing model results to measured data. A relatively large seiche that generated a 1.6 m peak displacement in water level measured at the Toledo gauge occurred during this period. ADCIRC was forced with GLERL wind fields for the one-month period, and model-generated water levels were compared with measurements recorded at 12 NOS and the CMEDS gauges located throughout Lake Erie. The twelve gauge locations are shown in Figure 2-5, and include Cleveland and Toledo, Ohio, Erieau, Ontario, and Buffalo, New York, which were selected for comparisons in the text. The complete set of comparisons is contained in Appendix C. Model-generated water levels for this period compare favorably well in range and phase to the measured data in the western and central Lake basins (Figures 2-6 through 2-9). However, accuracy of the model-generated water levels diminished in the eastern basin, with the least favorable comparison being observed at Buffalo, New York. Discrepancies between model-generated and measured water levels are attributed to inaccuracies in the wind fields in the eastern Lake basin and the neglect of barometric pressure variation.

Figure 2-10 compares a time-series of measured and GLERL-generated wind speed and direction for Buoy No. 45005, maintained by the NOAA National Data Buoy Center. This buoy resides approximately 28 nm northwest of

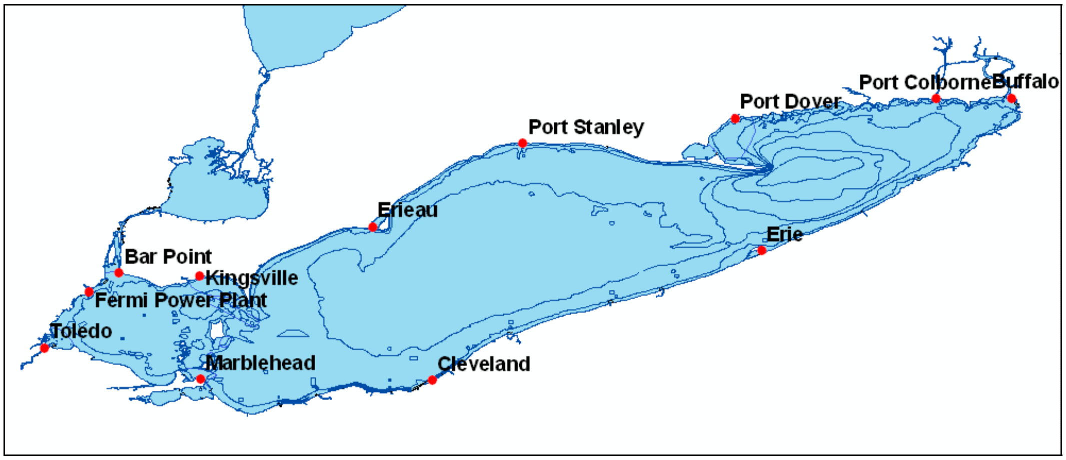


Figure 2-5. Location of Gauges used in Calibration and Validation Exercises.

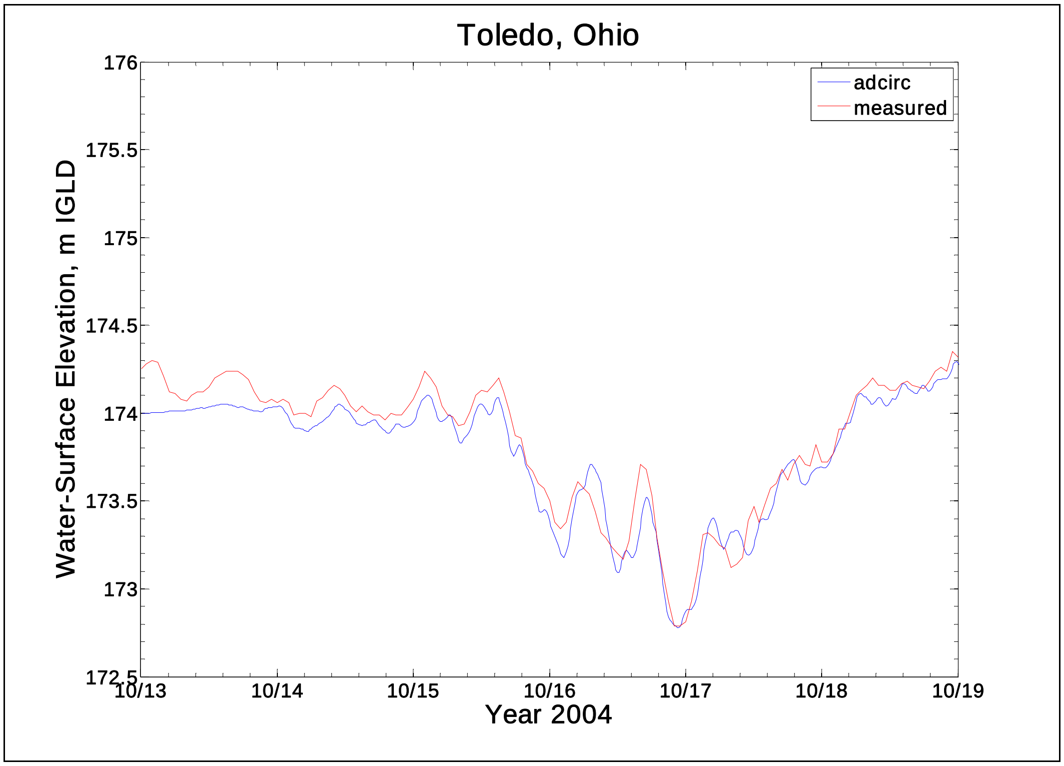


Figure 2-6. Comparison of model-generated and measured water-surface elevations: Toledo, OH, 13-19 Oct 2004.

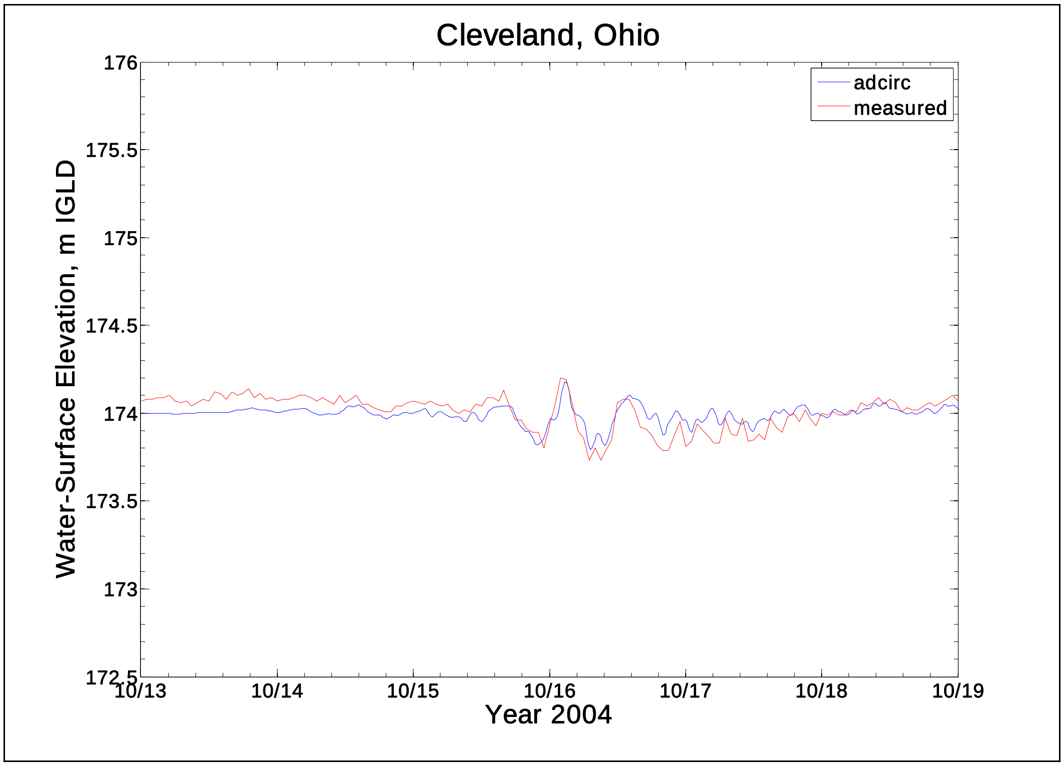


Figure 2-7. Comparison of model-generated and measured water-surface elevations: Cleveland, OH, 13-19 Oct 2004.

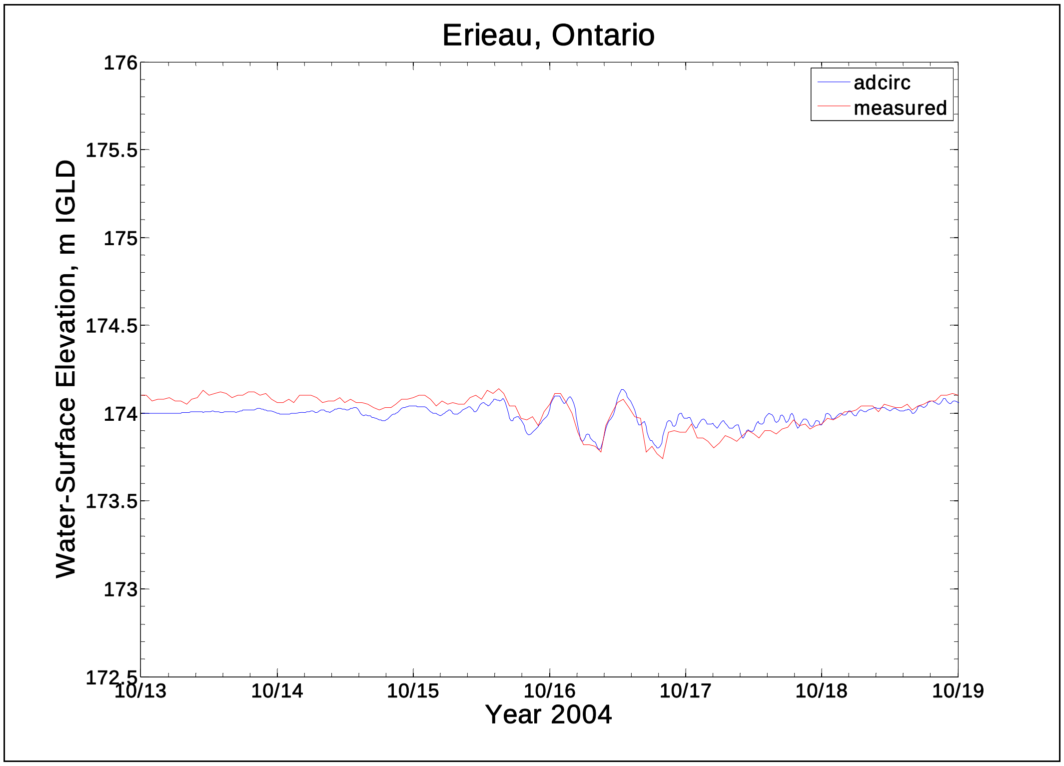


Figure 2-8. Comparison of model-generated and measured water-surface elevations: Erieau, Ontario, 13-19 Oct 2004.

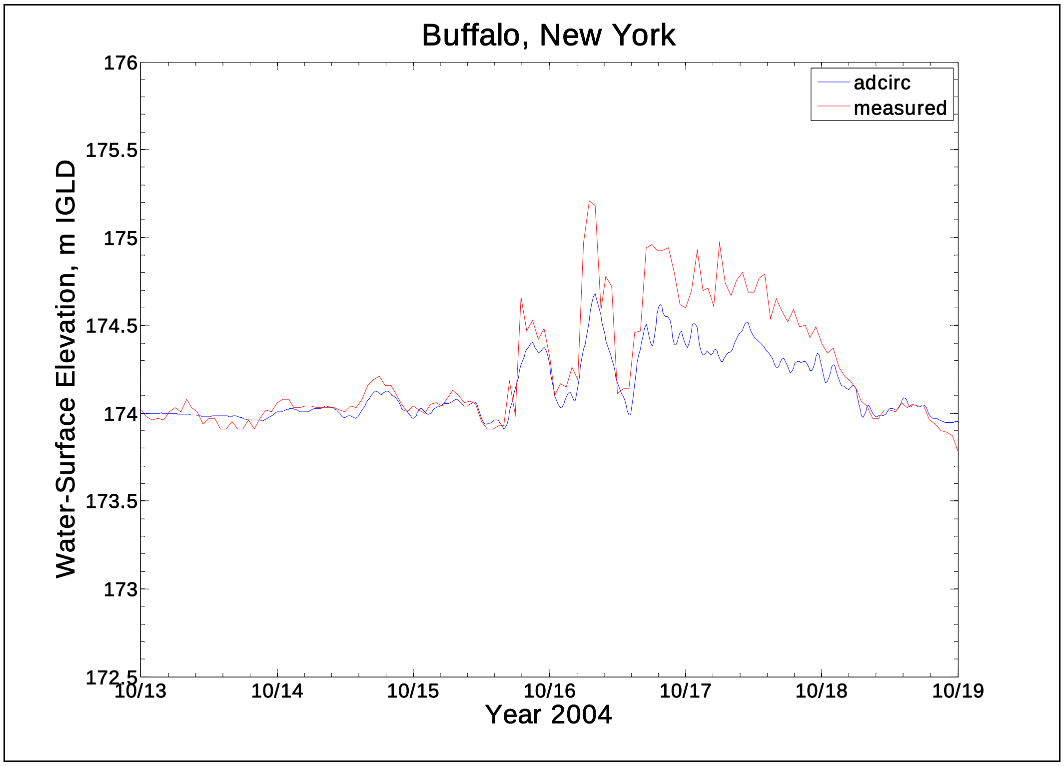


Figure 2-9. Comparison of model-generated and measured water-surface elevations: Buffalo, NY, 13-19 Oct 2004.

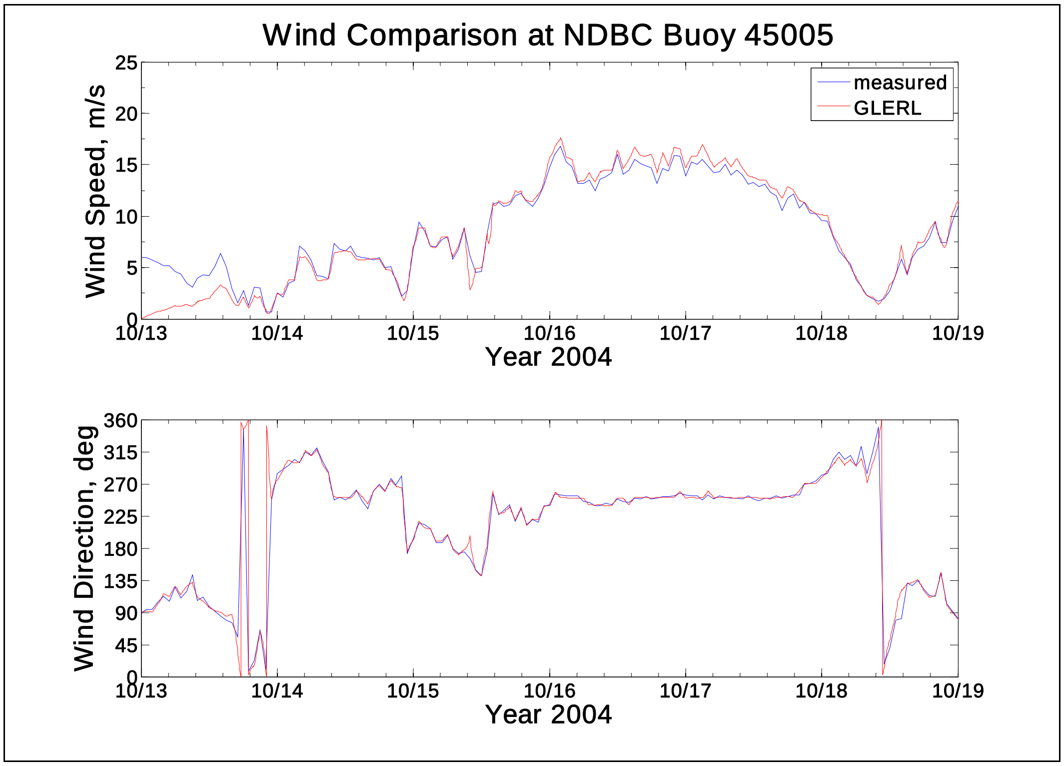


Figure 2-10. Comparison of GLERL-generated and measured wind speeds and directions: NDBC Buoy 45005, 13-19 Oct 2004.

Cleveland Harbor, in the western extent of the central Lake basin. As shown in this figure, the GLERL-generated winds compare very well with the measured winds, in both speed and direction. Differences in wind speeds are less than 1 m/s throughout the calibration period.

Figure 2-11 compares time-series of GLERL-generated winds with those measured at Burke Lakefront Airport, which is located in the Cleveland Harbor complex. For the majority of the calibration period, the GLERL-generated winds over estimated the measured wind speed by approximately 5 m/s, and wind direction differed by about 15 deg.

Figure 2-12 compares a time-series of GLERL-generated winds with those measured at Buffalo International Airport, which is located approximately 8.5 miles east of the lakefront. The GLERL-generated winds tend to be greater than the peak measured winds by about 2 m/s, whereas computed wind directions compare favorably with the measured directions. Discrepancies between the GLERL-generated winds and measured winds recorded at Burke and Buffalo International Airports are attributed to adjustments made to the GLERL-generated winds to account for over-land wind effects inherently included in the measured winds.

Substantial differences are found, however, when comparing measured winds recorded at Buffalo and Port Colborne, which is located 19 miles west of Buffalo. Shown in Figure 2-13, wind speeds measured at Port Colborne can be twice as strong during a storm as those measured at Buffalo. (No wind records were found for the calibration and validation period, necessitating the use of the Fall 2002 period as a proxy.) A similar comparison and findings were made between the GLERL-generated and measured winds for Port Colborne during this period (Figure 2-14), where the GLERL-generated winds were much weaker than the measured winds during storms.

The differences in wind strength are attributed to: a) the Port Colborne anemometer being located on the lakefront, whereas the Buffalo anemometer residing inland; and b) the GLERL-generated being tuned to the Buffalo anemometer. As such, the GLERL-generated winds imposed in the circulation model were too weak in the eastern Lake basin, resulting in reduced storm surge levels at Buffalo.

The November 2004 time period was selected for model validation. As in the calibration exercise, ADCIRC was forced with GLERL-generated wind fields for this second period. ADCIRC water level results were again compared with water levels measured at the 12 NOS and the CMEDS gauges. The model-

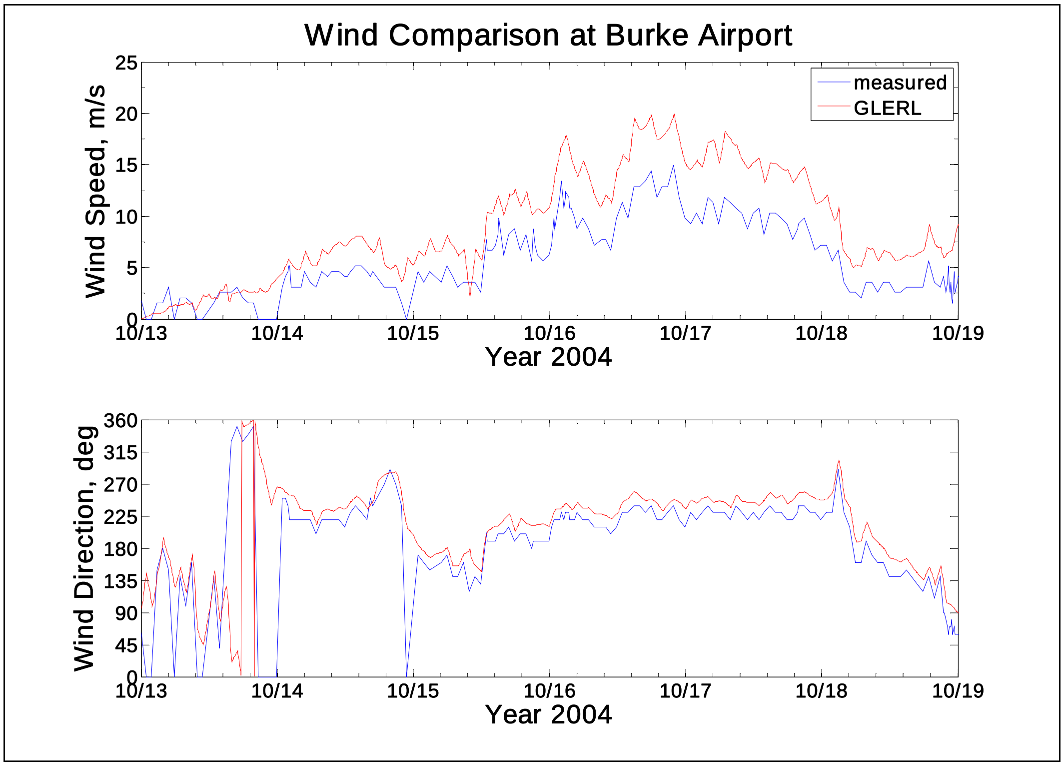


Figure 2-11. Comparison of GLERL-generated and measured wind speeds and directions: Burke Lakefront Airport (Cleveland, OH), 13-19 Oct 2004.

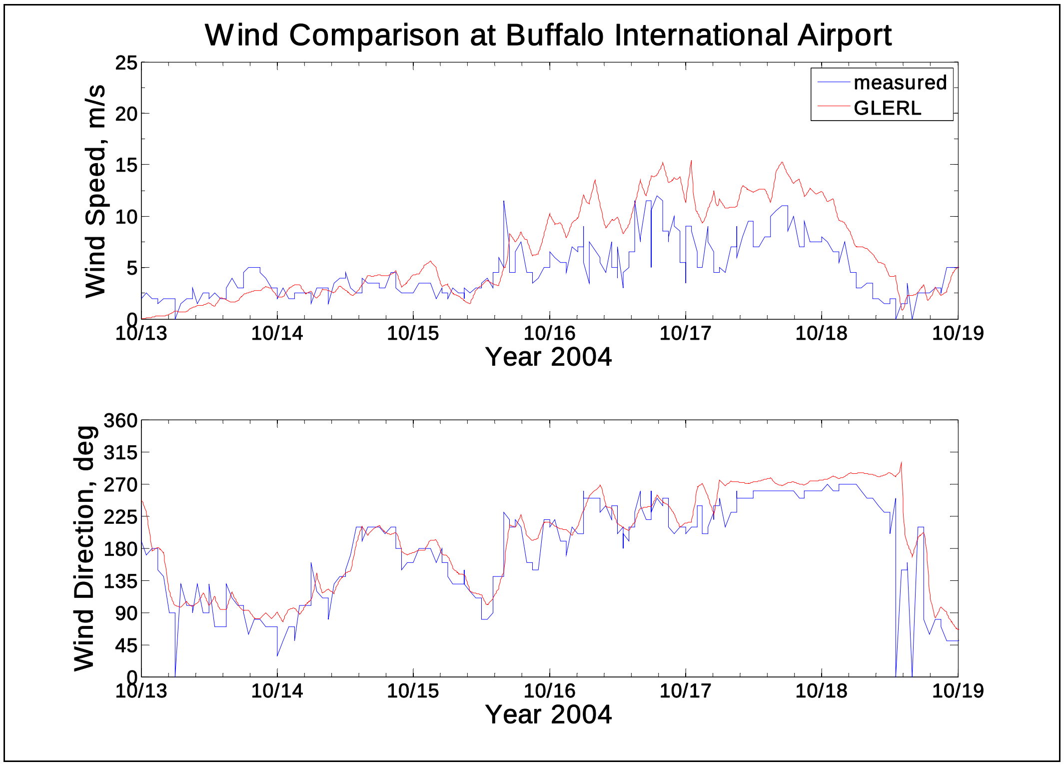


Figure 2-12. Comparison of GLERL-generated and measured wind speeds and directions: Buffalo International Airport, 13-19 Oct 2004.

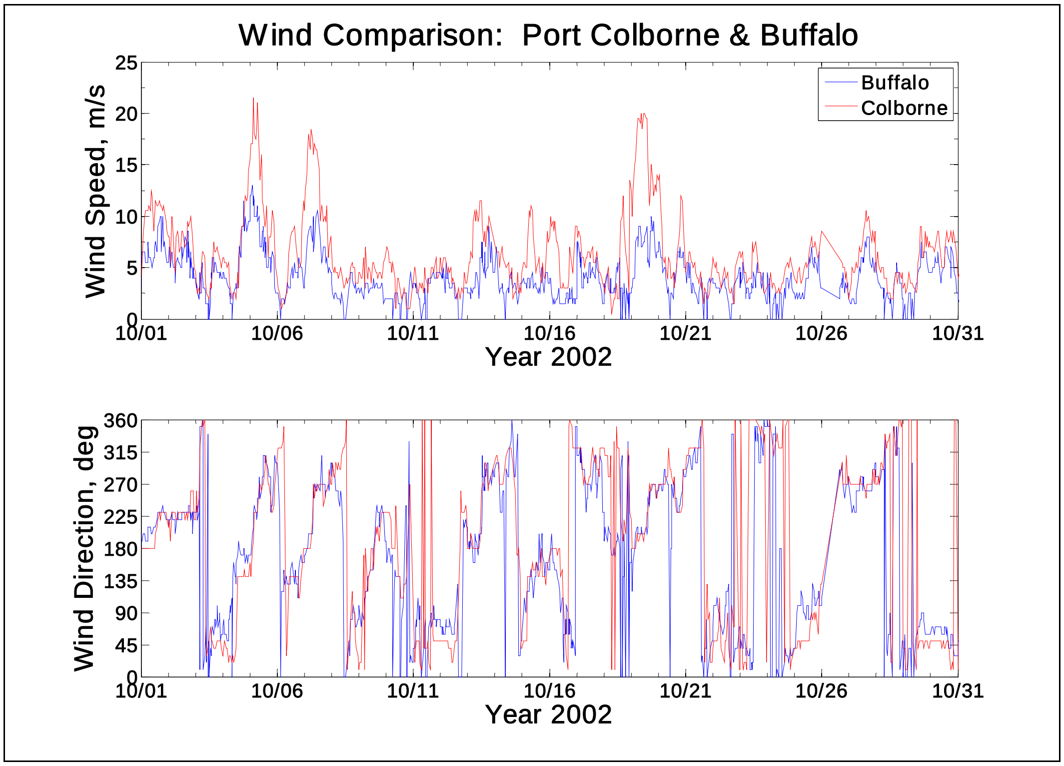


Figure 2-13. Comparison of measured wind speeds and directions at Port Colborne, Ontario and Buffalo International Airport: 1-31 Oct 2002.

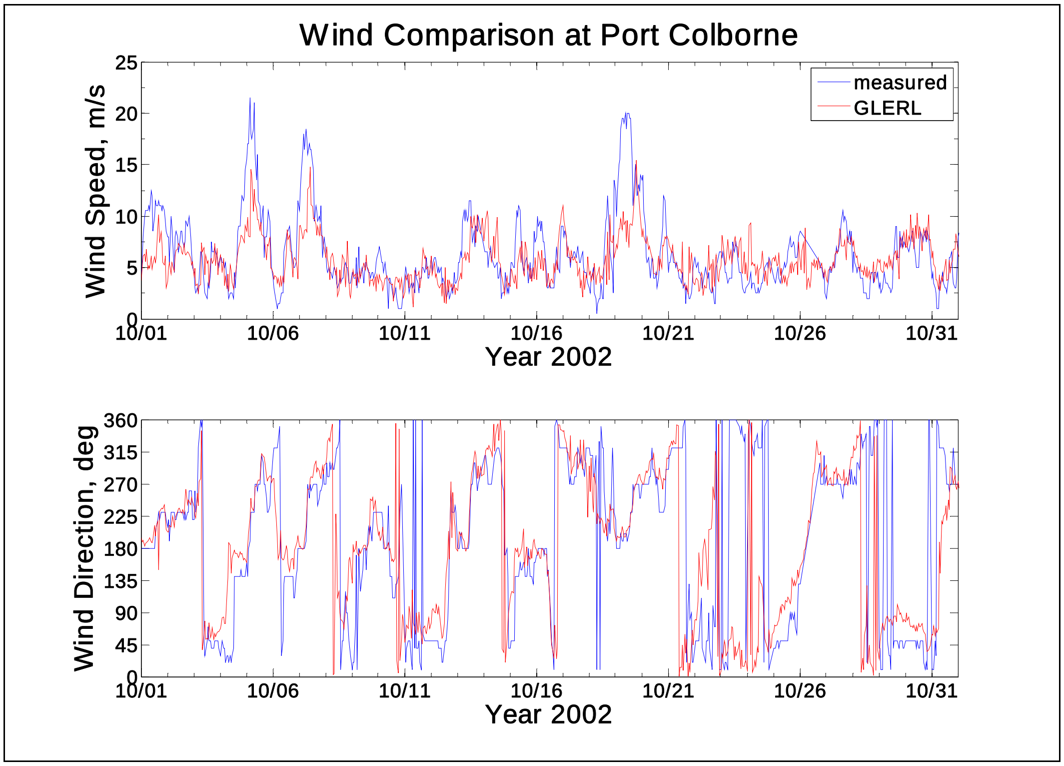


Figure 2-14. Comparison of GLERL-generated and measured wind speeds and directions: Port Colborne, Ontario, 1-31 Oct 2002.

generated water levels again compared favorably in range and phase with the NOAA gauge measurements (Figures 2-15 through 2-18) at Toledo, Cleveland, and Erieau. As with the calibration period, the model did not generated water levels to a high degree of accuracy at Buffalo (Figure 2-19). Again, this discrepancy between model-generated and measured water levels at Buffalo is attributed to the winds being too weak in the eastern Lake basin. Figures 2-19 through 2-21 compare GLERL-generated winds with measured winds for Buoy 45005, Burke Airport, and Buffalo International Airport, respectively.

Harbor Configuration Testing

The grid constructed for the existing Harbor configuration was adapted to represent each of the three proposed CDF configurations. Figures 2-22 and 2-23 display the outline of the CDF and the grid, respectively, for Configuration 1. Figures 2-24 and 2-25 display the outline of the CDF and the grid, respectively for Configuration 2. Figures 2-26 and 2-27 display the outline of the CDF and the grid, respectively, for Configuration 3. Each configuration represents a particular phase in construction, with Configuration 1 representing the earliest phase and Configuration 3 depicting final construction.

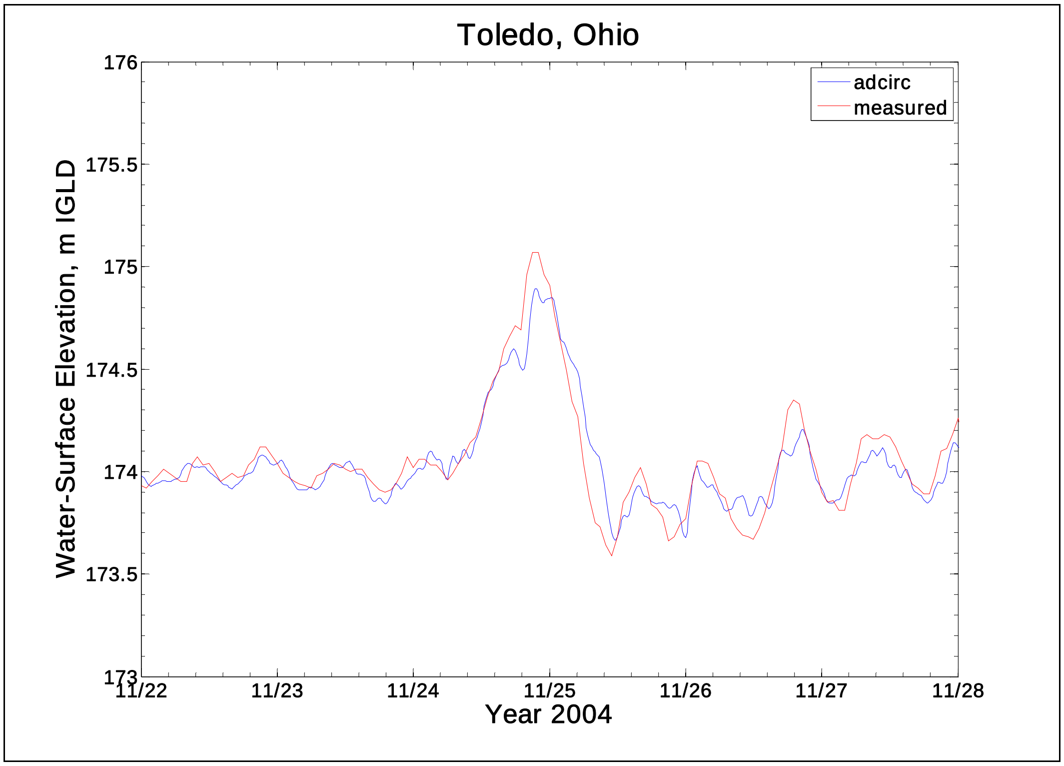


Figure 2-15. Comparison of model-generated and measured water-surface elevations: Toledo, OH, 22-28 Nov 2004.

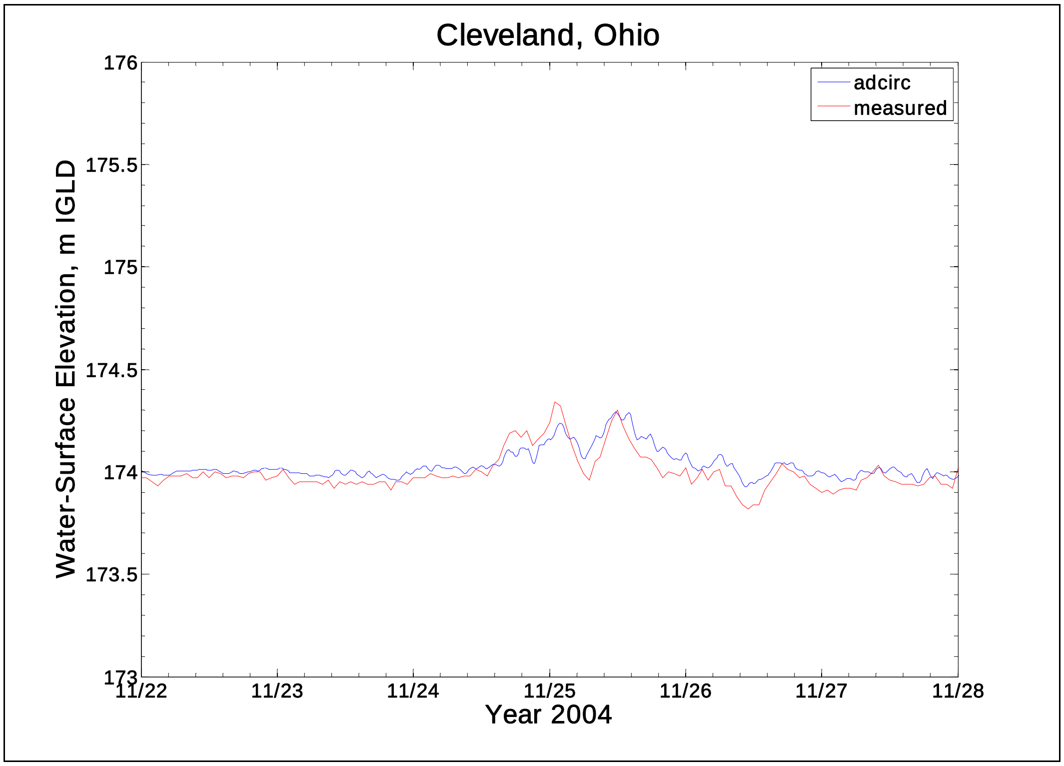


Figure 2-16. Comparison of model-generated and measured water-surface elevations: Cleveland, OH, 22-28 Nov 2004.

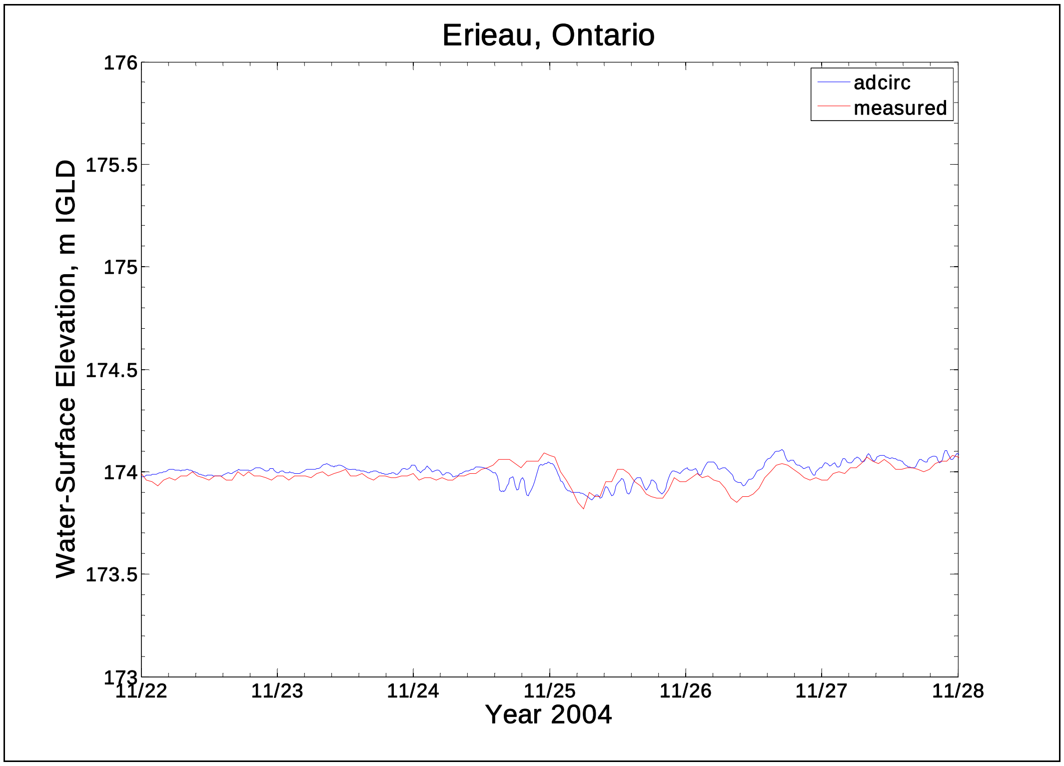


Figure 2-17. Comparison of model-generated and measured water-surface elevations: Erieau, Ontario, 22-28 Nov 2004.

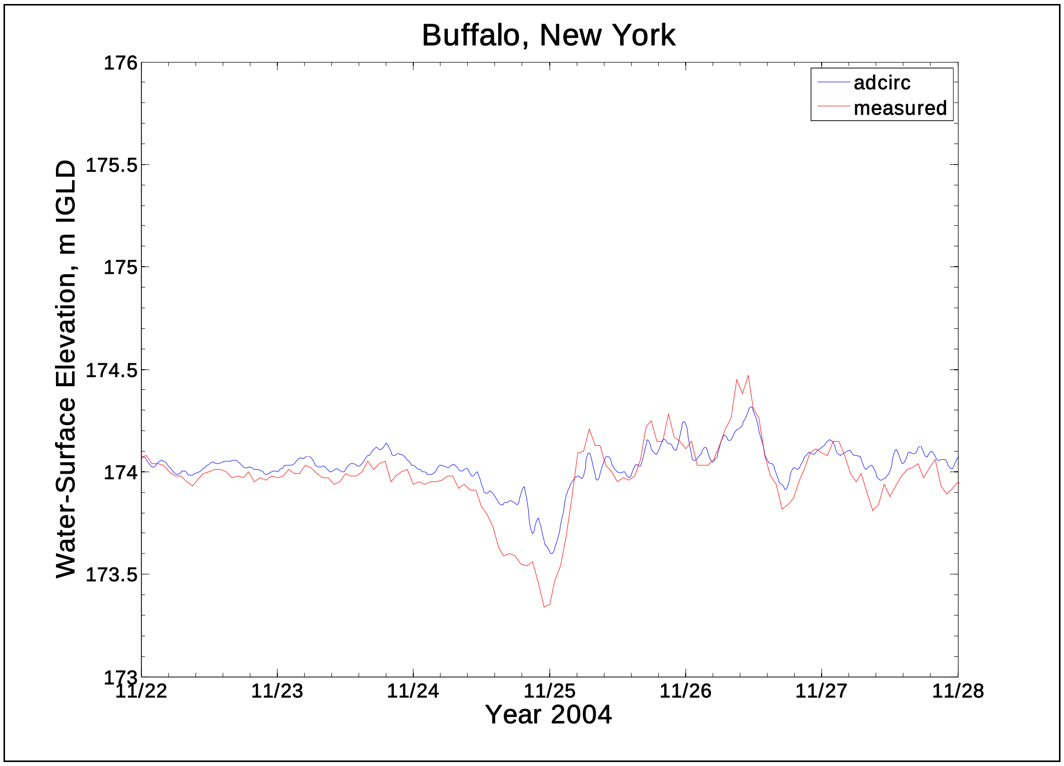


Figure 2-18. Comparison of model-generated and measured water-surface elevations: Buffalo, NY, 11-28 Nov 2004.

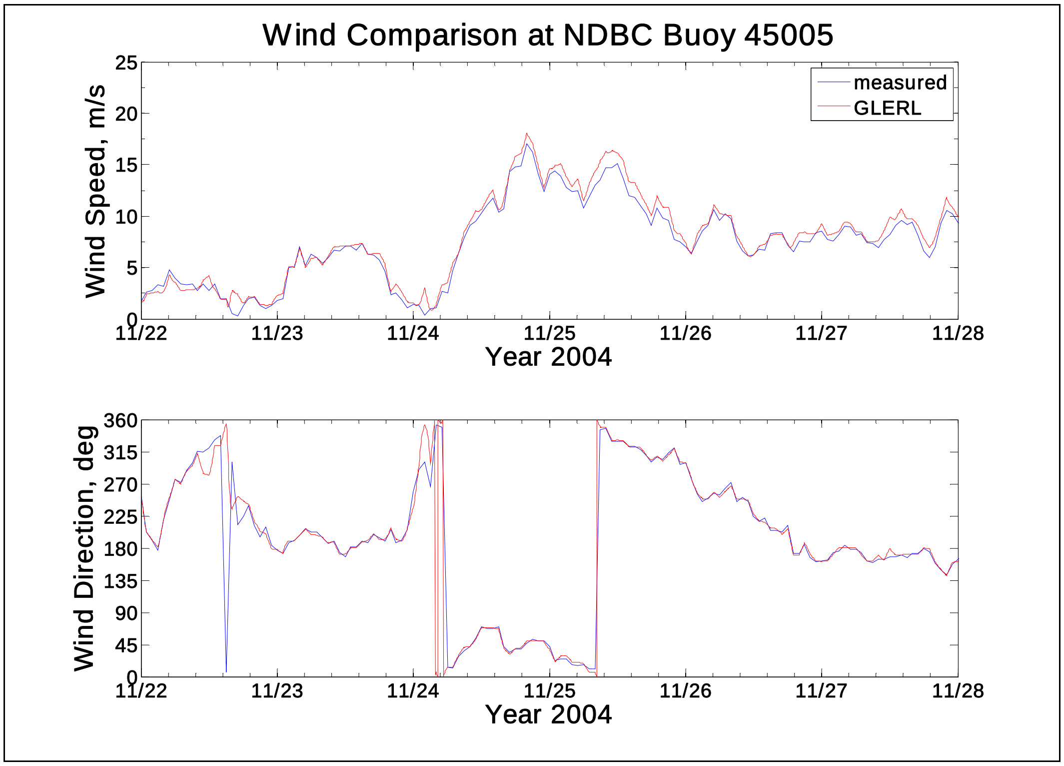


Figure 2-19. Comparison of GLERL-generated and measured wind speeds and directions: NDBC Buoy 45005, 22-28 Nov 2004.

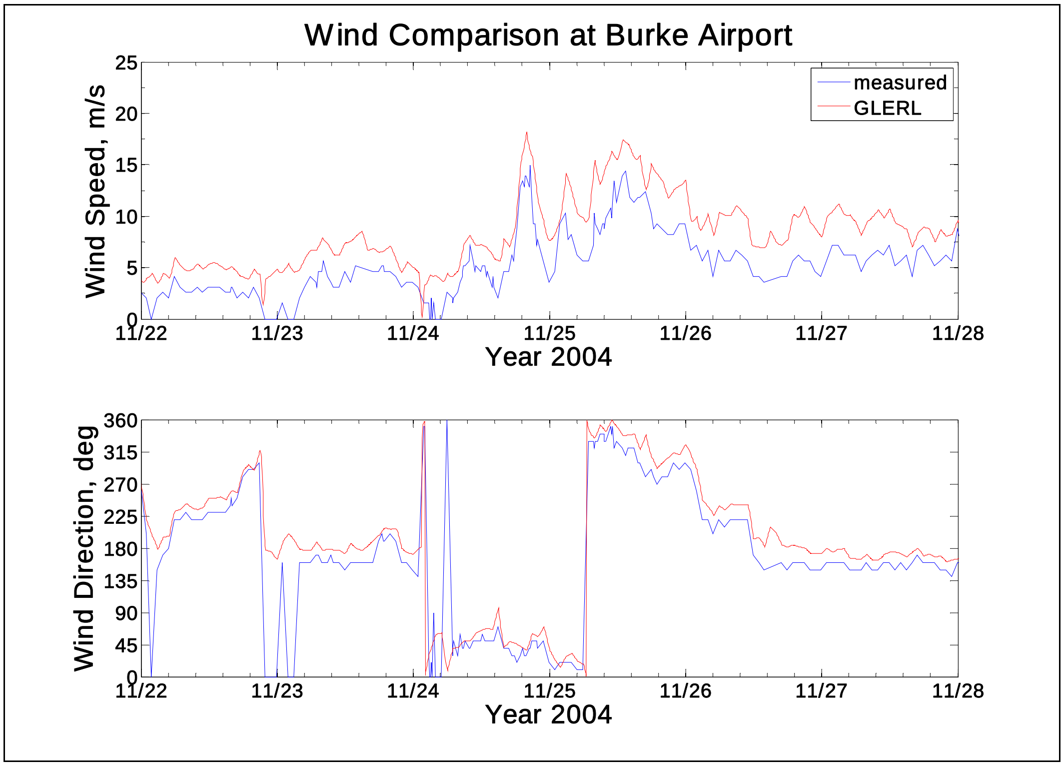


Figure 2-20. Comparison of GLERL-generated and measured wind speeds and directions: Burke Lakefront Airport (Cleveland, OH), 22-28 Nov 2004.

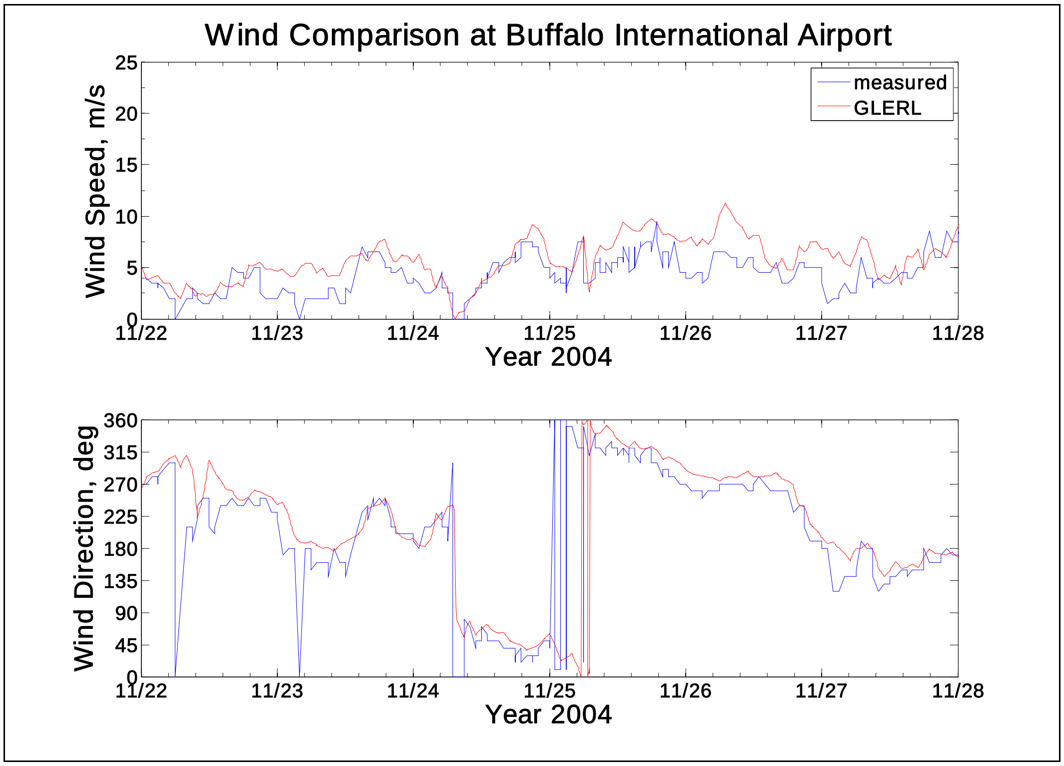


Figure 2-21. Comparison of GLERL-generated and measured wind speeds and directions: Buffalo International Airport, 22-28 Nov 2004.

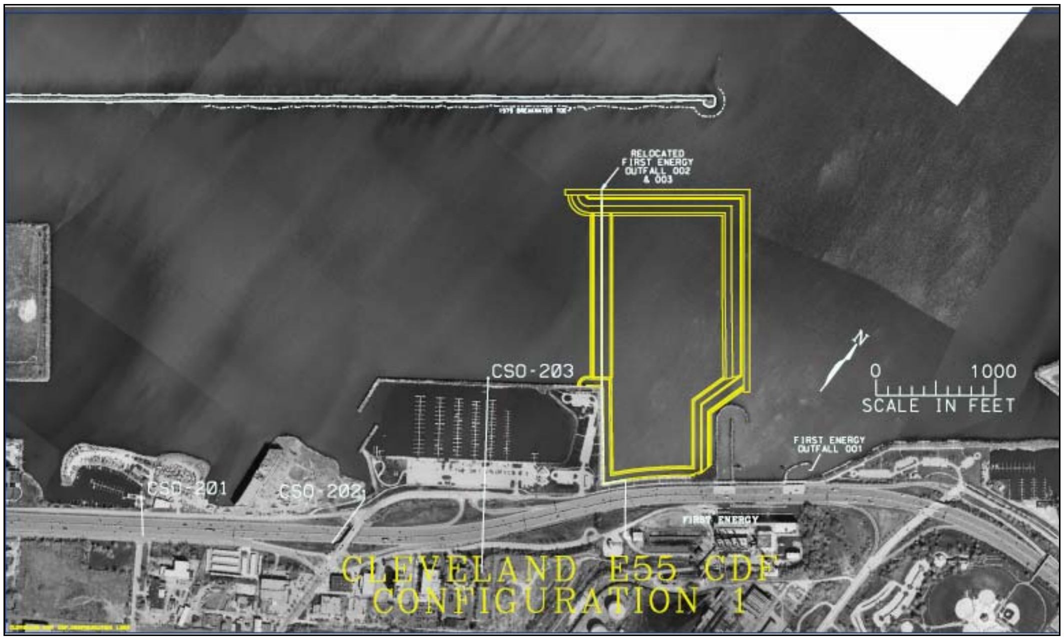


Figure 2-22. Plan CDF Configuration 1.

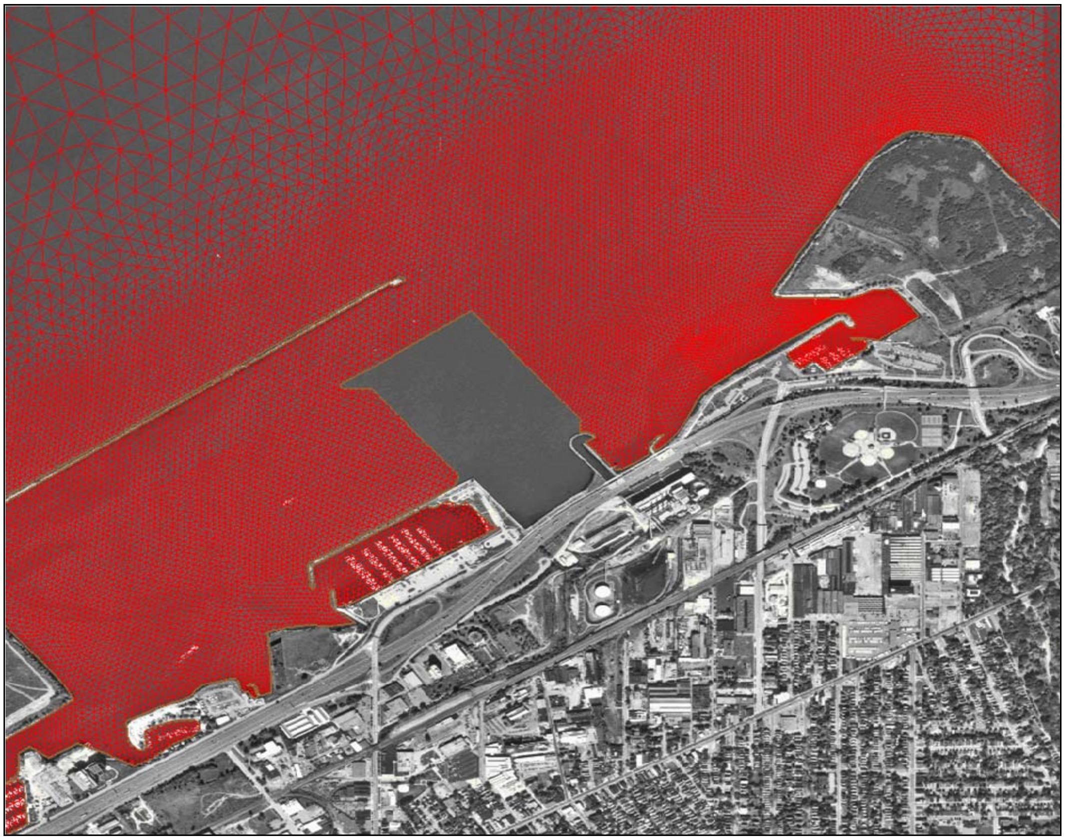


Figure 2-23. Plan Configuration 1.

Figure 2-24. Plan CDF Configuration 2.

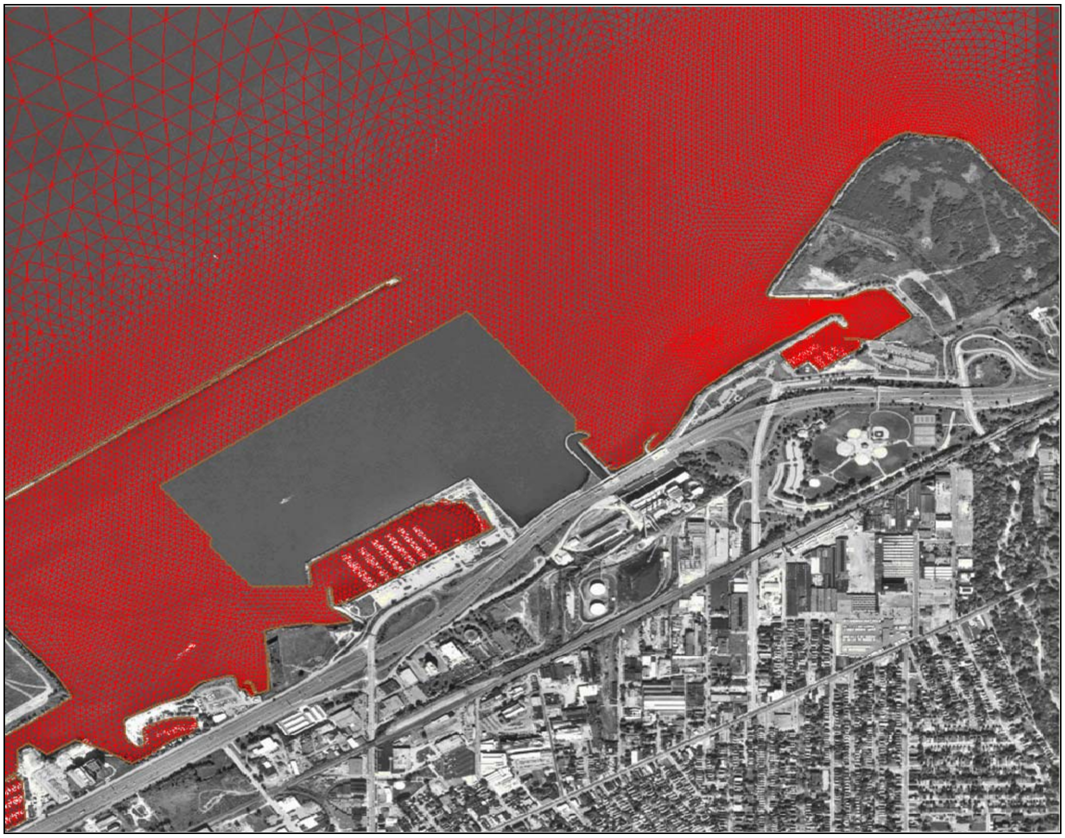


Figure 2-25. Plan Configuration 2.

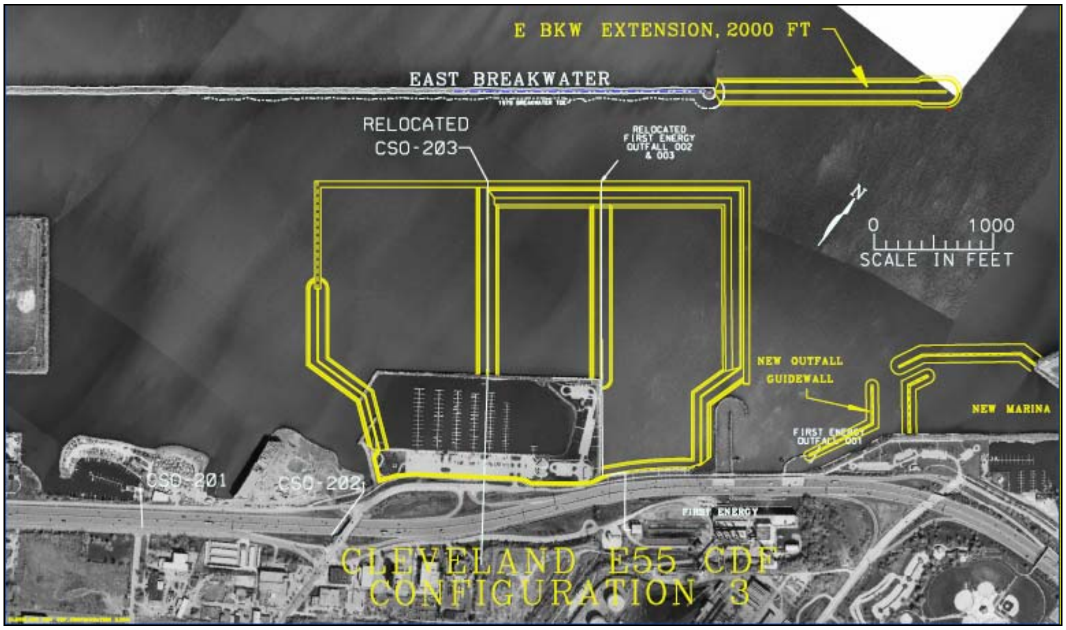


Figure 2-26. Plan CDF Configuration 3.

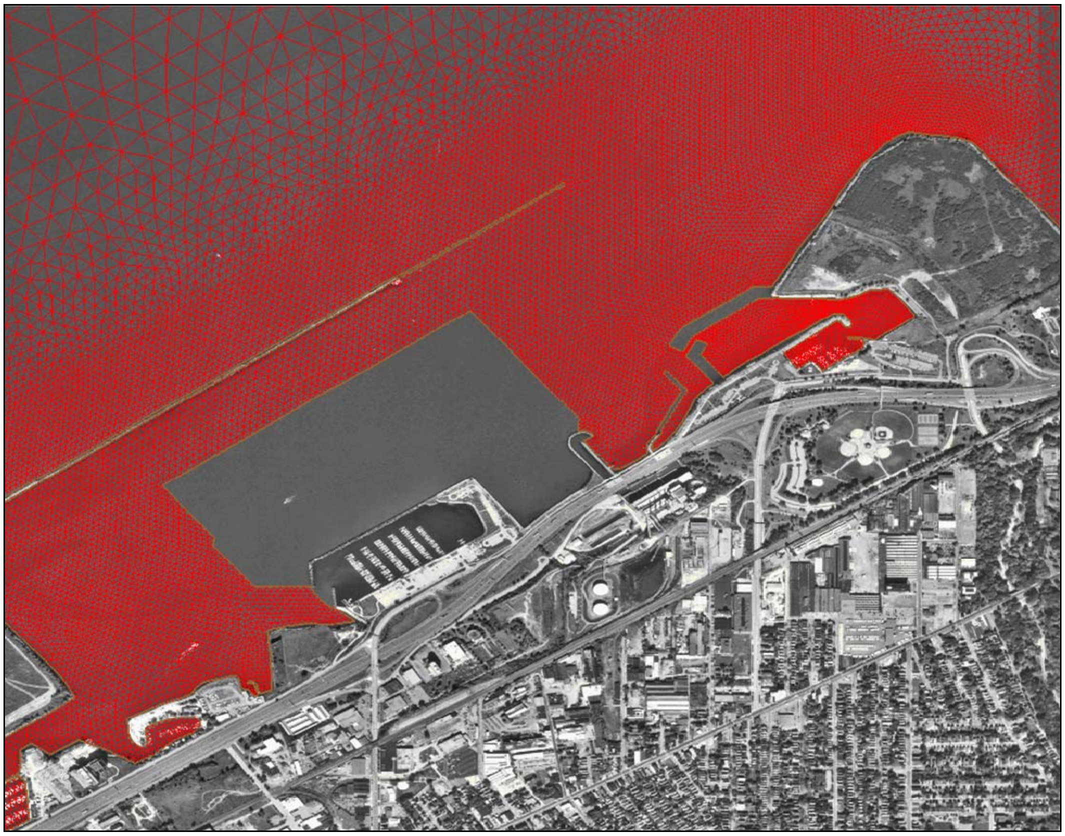


Figure 2-27. Plan Configuration 3.

Aligned with the eastern limit of the breakwater sheltering the East 55th St. Marina, Configuration 1 extends 730 m from the shoreline towards the northwest and measures 470 m in the alongshore direction. As such, the width of the federally-maintained Harbor channel is decreased from 65 m to 50 m.

Relative to Configuration 1, Configuration 2 extends further to the southwest by approximately 638 m, terminating at the entrance to the East 55th St. Marina. Differences between Configuration 2 and 3 are: 1) the East 55th St. Marina is filled, becoming part of the CDF; 2) jetties are placed at the entrance to the Gordon Park marina, which resides east of the power plant outfall; 3) a guide wall separates the outfall discharge from the intake; and, 4) the East Breakwater is extended by 610 m.

The existing-condition or base grid was developed with nodes lying along the outer extents/limits of each CDF configuration. Developing the grid in this manner permits each CDF to be readily incorporated into the base grid by deleting those elements and nodes lying within the lateral extents of each particular CDF. This also permits more accurate comparison between alternatives to be made because the nodal positions and their connectivity (i.e., elements) were not changed.

A series of simulations were conducted for evaluating the hydrodynamic changes induced by constructing the three CDFs. The first series is a hindcast simulation of the November 2004 storm used in validating the ADCIRC model where the base and three configurations were simulated for this period.

Figures 2-28 through 2-31 display the peak westerly current during the November storm, whereas Figures 2-32 through 2-35 display the peak easterly current. Under easterly wind conditions, the westerly currents within the modified channel increased from about 0.05 m/s to approximately 0.4 m/s for Configuration 1 (Figure 2-36). Similar increases were noted for Configurations 2 and 3, where the peak currents increased to 0.4 m/s for both planned conditions. Stronger currents induced by the planned CDFs are attributed to the reduced cross-sectional area within the channel.

Current in Gordon Park Marina can be characterized as weak. Time-series of model-generated current for the base and three planned configurations for the marina is presented in Figure 2-37. As shown, the planned configurations do not appear to have an appreciable impact on current strength in the marina. This observation should not be construed that the CDFs will have no impact on flushing rates in this marina or that the planned construction will not degrade water quality. To make these determinations, a particle-tracking or water-quality model, which account for transport and flux of material within the Harbor system will need to be used.

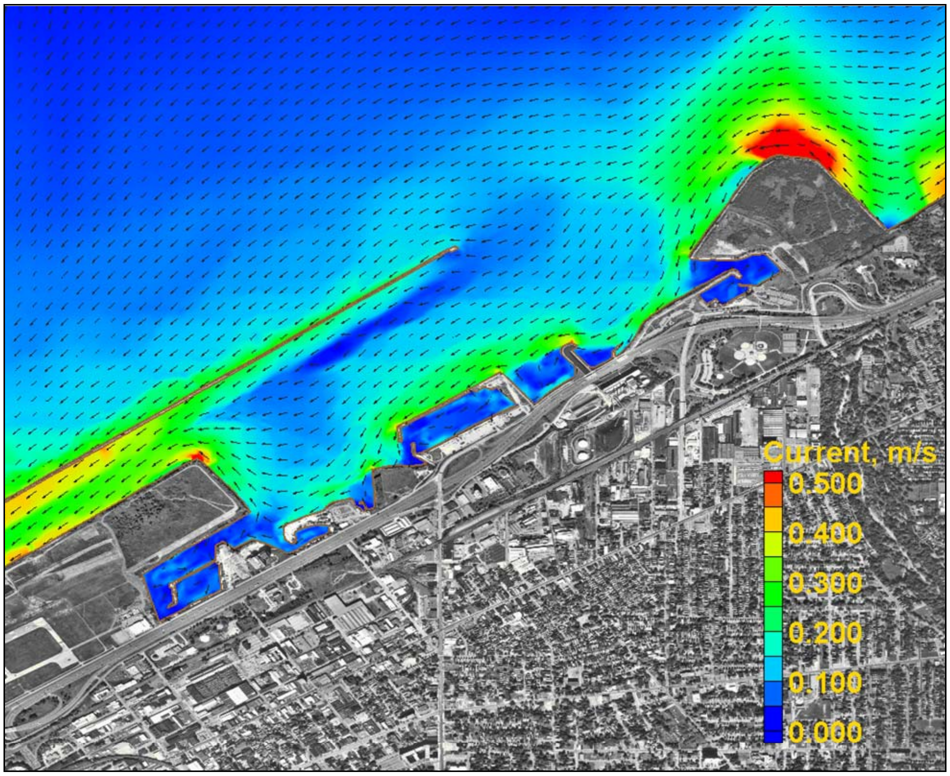


Figure 2-28. Base Configuration: Peak model-generated current during November 2004 storm (16 November 20:00:00 GMT).

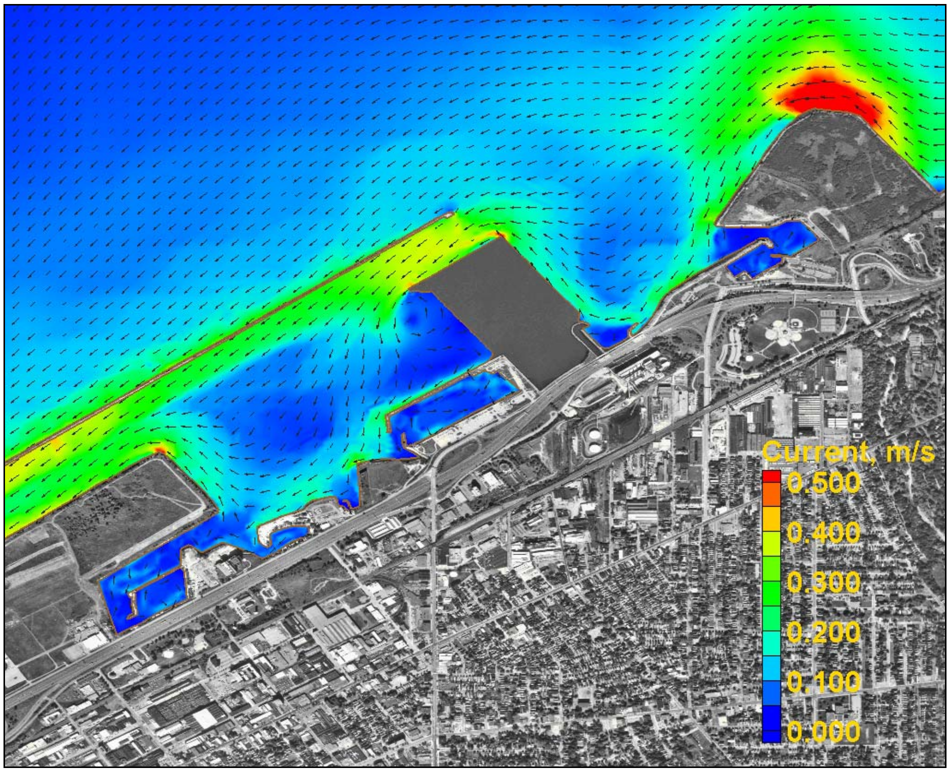


Figure 2-29. Plan Configuration 1: Peak model-generated current during November 2004 storm (16 November 20:00:00 GMT).

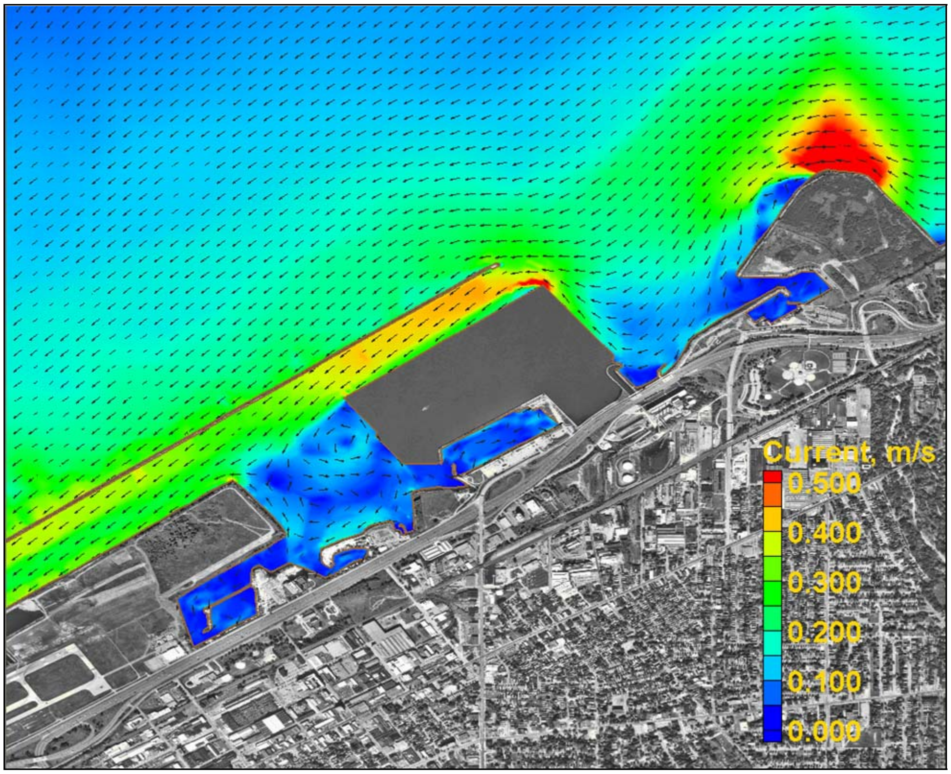


Figure 2-30. Plan Configuration 2: Peak model-generated current during November 2004 storm (16 November 20:00:00 GMT).

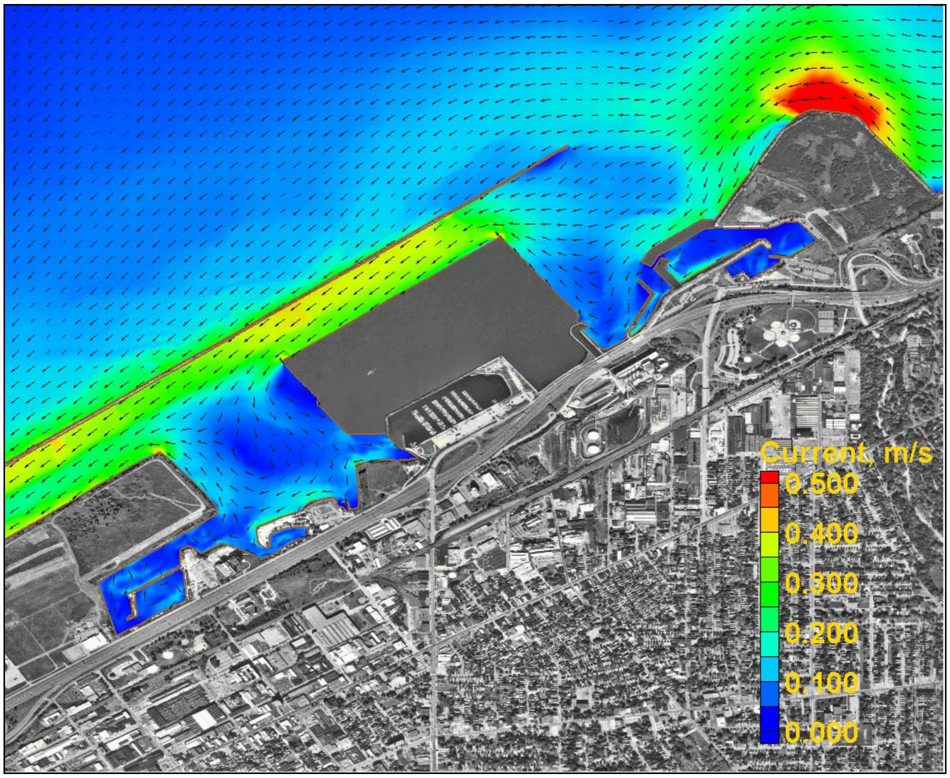


Figure 2-31. Plan Configuration 3: Peak model-generated current during November 2004 storm (16 November 20:00:00 GMT).

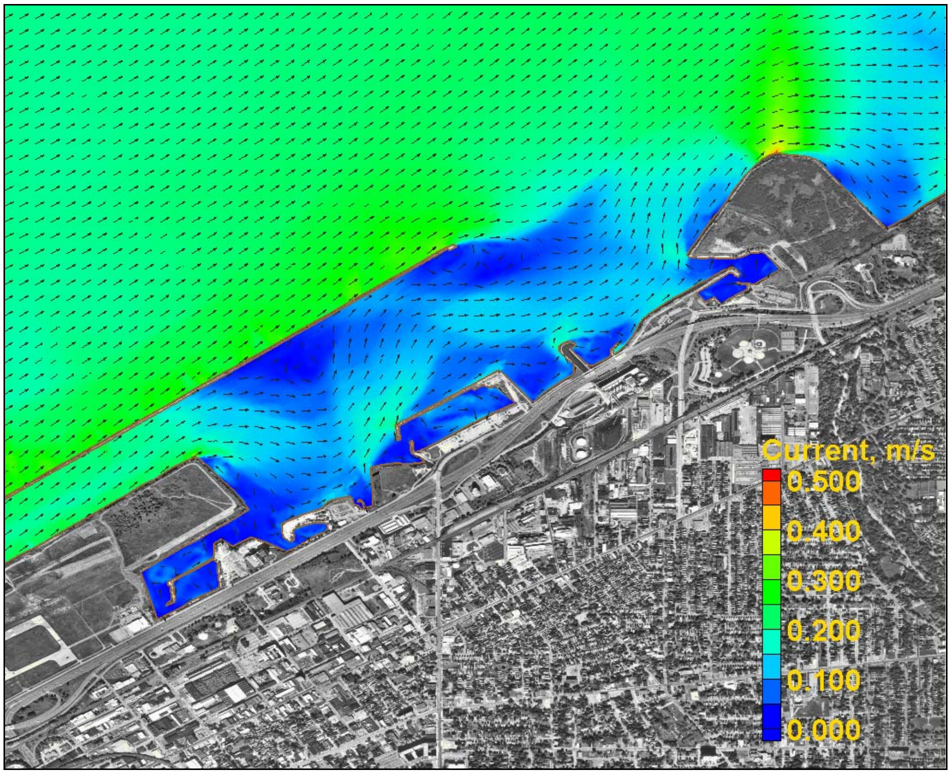


Figure 2-32. Base Configuration: Peak model-generated current during November 2004 storm (17 November 19:00:00 GMT).

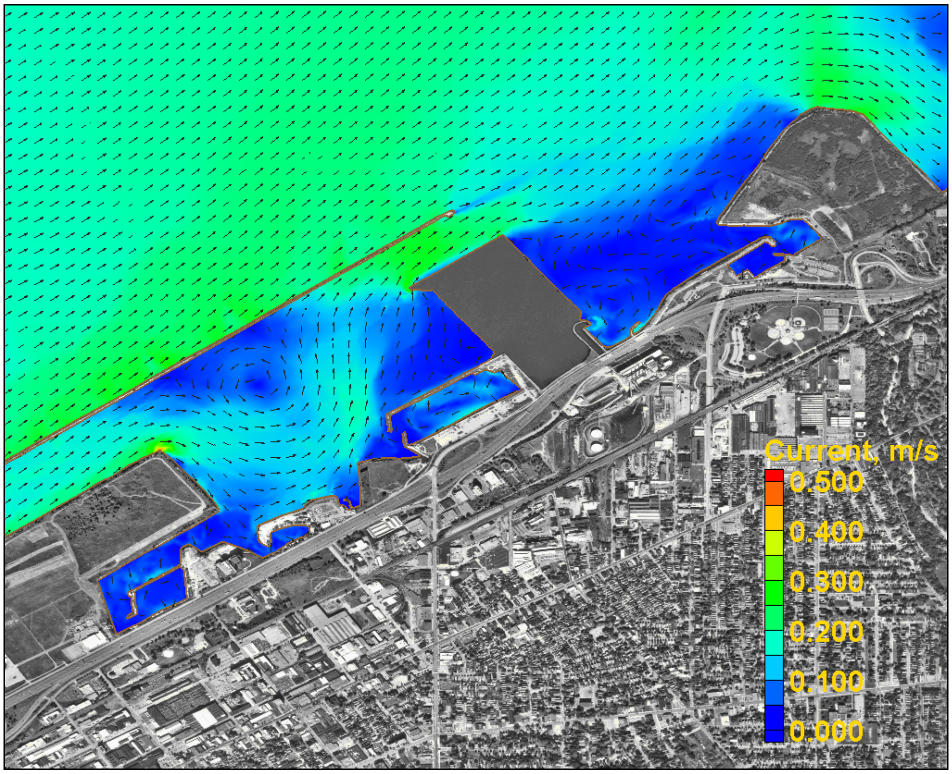


Figure 2-33. Plan Configuration 1: Peak model-generated current during November 2004 storm (17 November 19:00:00 GMT).

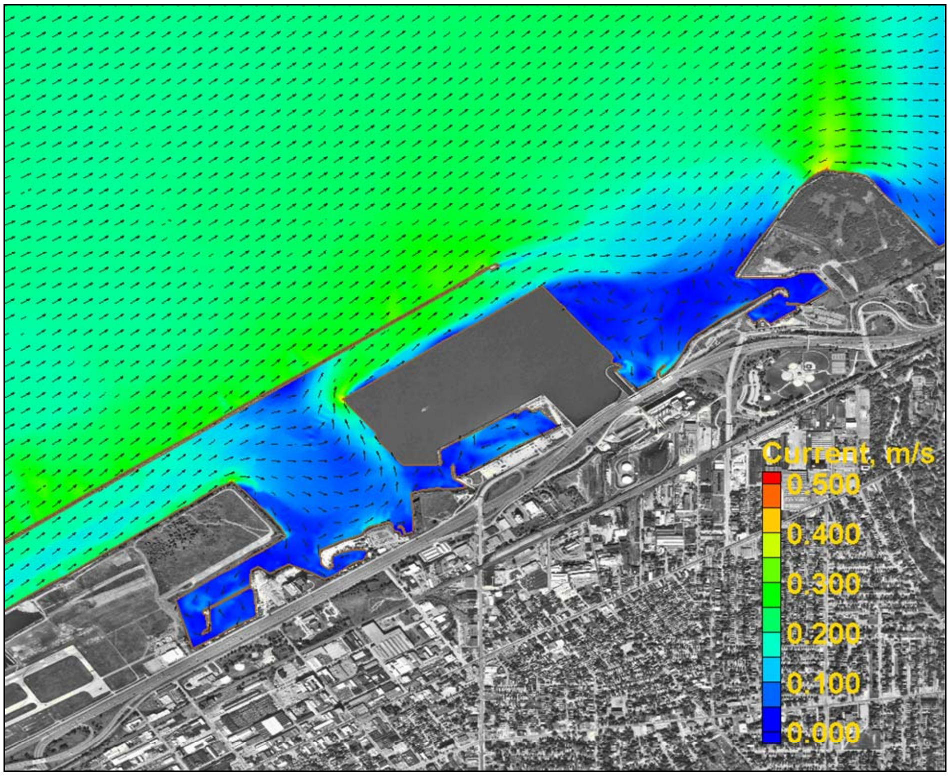


Figure 2-34. Plan Configuration 2: Peak model-generated current during November 2004 storm (17 November 19:00:00 GMT).

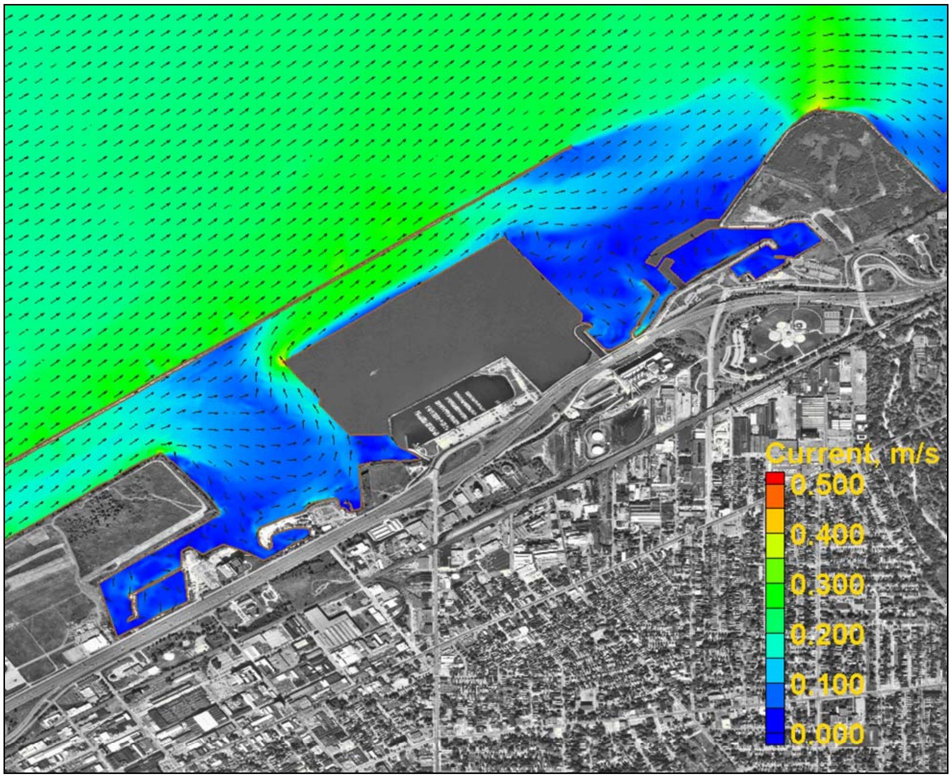


Figure 2-35. Plan Configuration 3: Peak model-generated current during November 2004 storm (17 November 19:00:00 GMT).

Current at the East 55th Street Marina entrance can, also, be characterized as weak. Time-series of model-generated current for the base and three planned configurations for the marina is presented in Figure 2-38. As shown, the planned configurations appear to weaken the current, from about 0.15 m/s to 0.10 m/s during peak westerly current. The change in current strength is attributed to the sheltering caused by the planned configurations. As with the Gordon Park Marina, this observation should not be construed that the CDFs will impact flushing rates in this marina or that the planned construction will not degrade water quality.

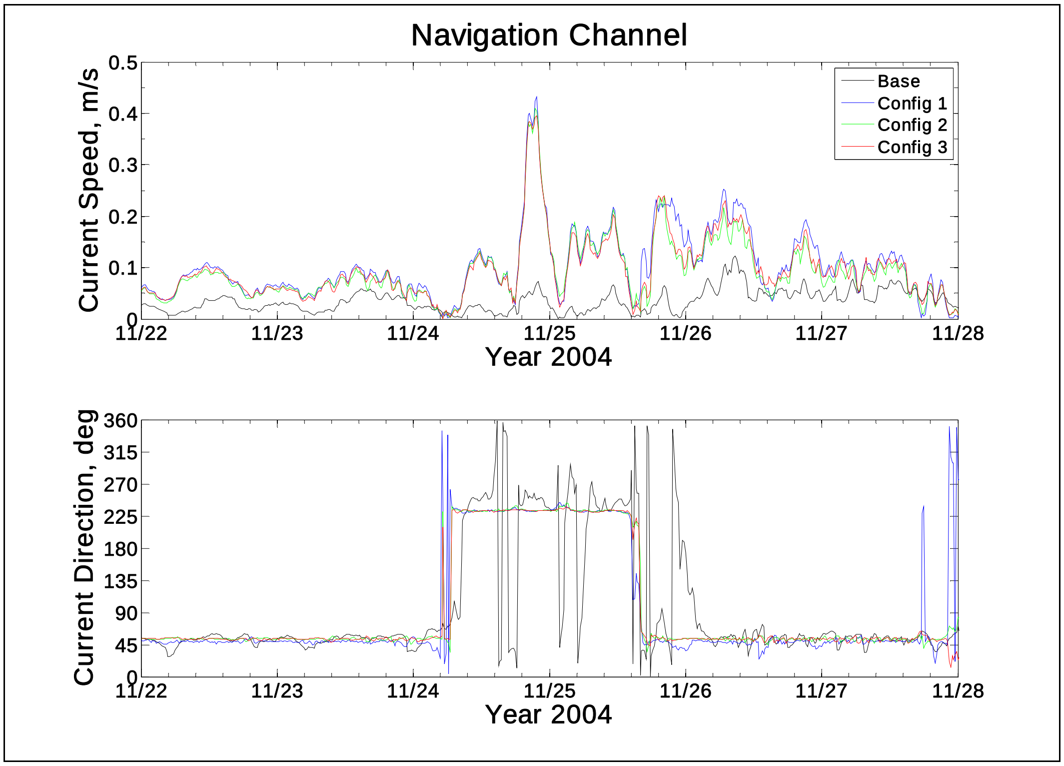


Figure 2-36. Comparison of current within the Navigation Channel.

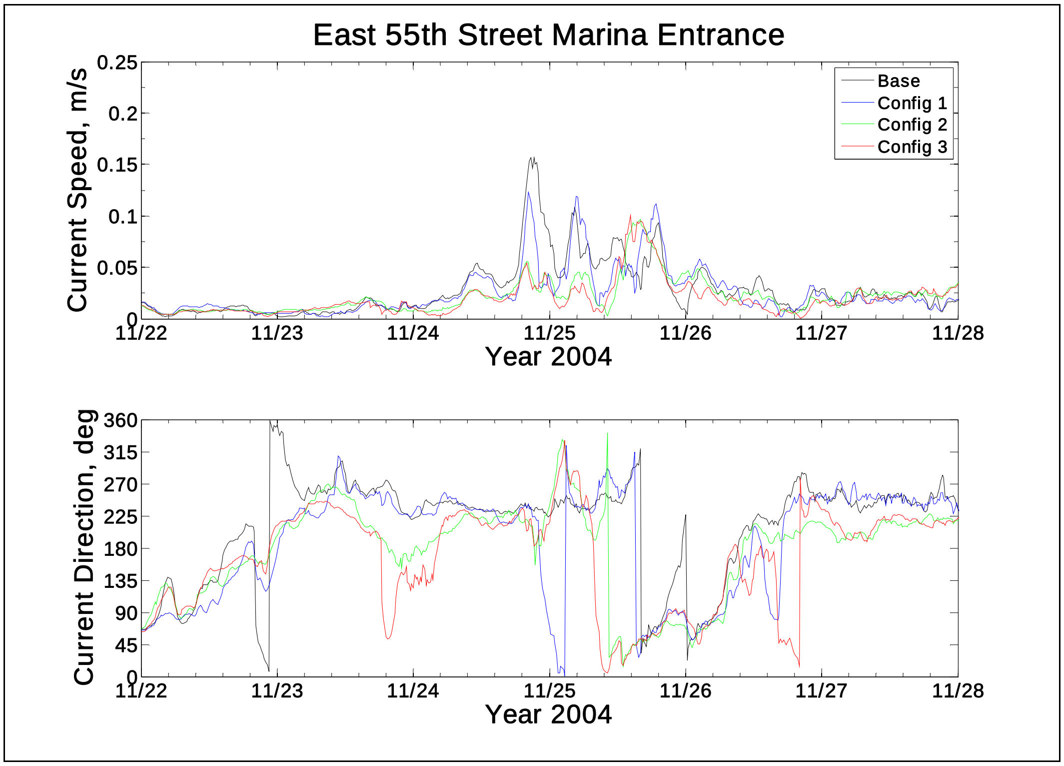


Figure 2-37. Comparison of current at the East 55th Street Marina Entrance.

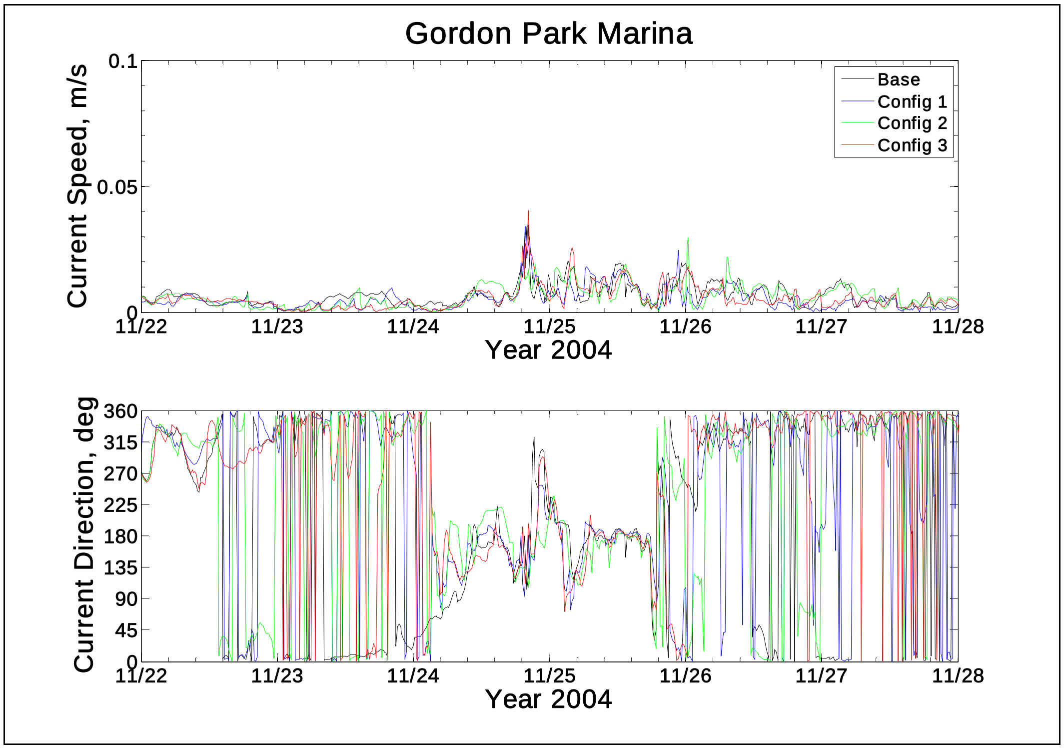


Figure 2-38. Comparison of current within Gordon Park Marina.

3 Thermal Transport Modeling

The three dimensional numerical hydrodynamic model CH3D-WES (Curvilinear Hydrodynamics in Three Dimensions–Waterways Experiment Station) can be applied in two vertical resolution modes, Z-grid and Sigma–grid. The Z-grid version is documented in Johnson, et al. (1991b). The Sigma-grid version, used in this study, is documented in Chapman et al. (1996). The basic Sigma-grid model (CH3D) was developed by Sheng (1986) for WES but has been extensively modified, including the development of the Z-grid version. These modifications have consisted of implementing different basic numerical formulations of the governing equations as well as substantial recoding of the model to provide additional computational efficiency. As its acronym implies, CH3D-WES performs hydrodynamic computations on a curvilinear or boundary-fitted plan-form grid. Physical processes impacting circulation and vertical mixing that are modeled include tides, wind, density effects (salinity and temperature), freshwater inflows, turbulence, and the effect of the earth's rotation.

The boundary-fitted coordinate feature of the model provides grid resolution enhancement necessary to adequately represent deep navigation channels and irregular shoreline configurations of the flow system. The curvilinear grid also permits adoption of accurate and economical grid schematization software. The solution algorithm employs an external mode, consisting of vertically averaged equations, which provides a solution for the free surface displacement for input to the internal mode, which contains the full 3D equations.

CH3D Hydrodynamic and Thermal Transport Simulations

The potential impact of the planned construction of the E 55th Street CDF on the near-field temperature distribution associated with the heated water discharge from the First Energy power plant (Figure 3-1) was investigated utilizing a depth averaged or single vertical layer CH3D hydrodynamic grid (Figure 3-2). The CH3D grid consists of 236 alongshore cells and 85 cross-shore cells, of which 14,944 are active computation cells with a fine-scale resolution of 5 to 10 meters. Details of the near-field region in the vicinity of the intake and outfall structures are shown in Figure 3–3 with overlays of proposed construction options. The modified grid resulting from the implementation of Configuration 2 is shown in

Figure 3-4, where it is seen that formerly active computational cells have been removed to represent the CDF.

Figure 3-1. Google Earth snapshot of the First Energy Power Plant, thermal outfall (right) and cooling water intake (left) structures.

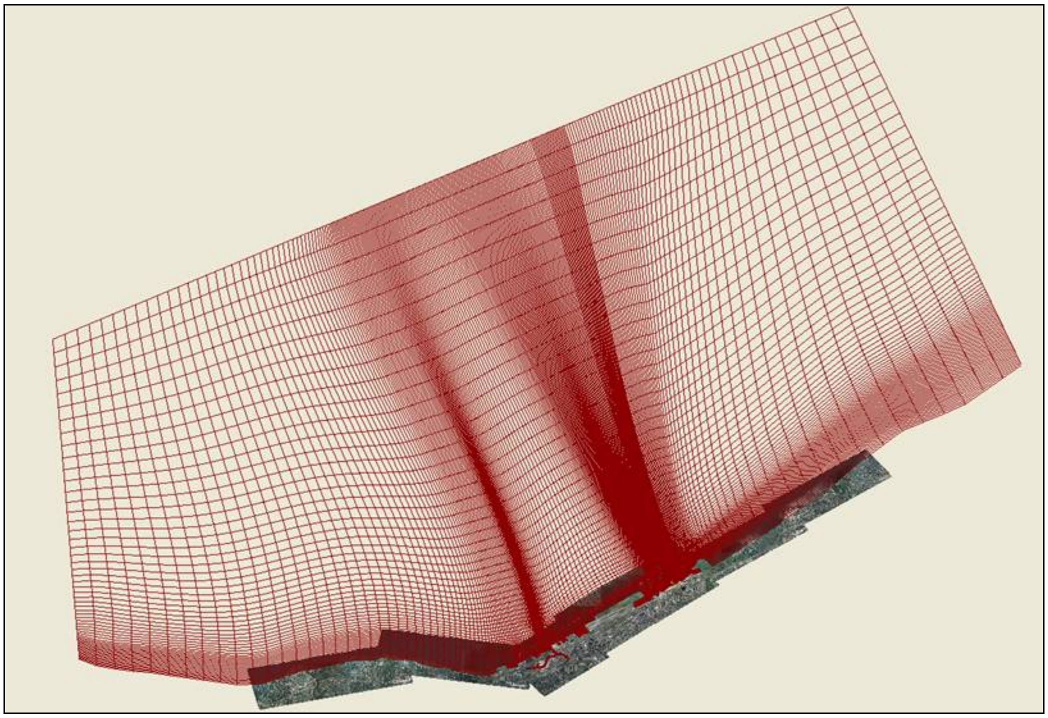


Figure 3-2. Cleveland Harbor CH3D boundary-fitted grid.

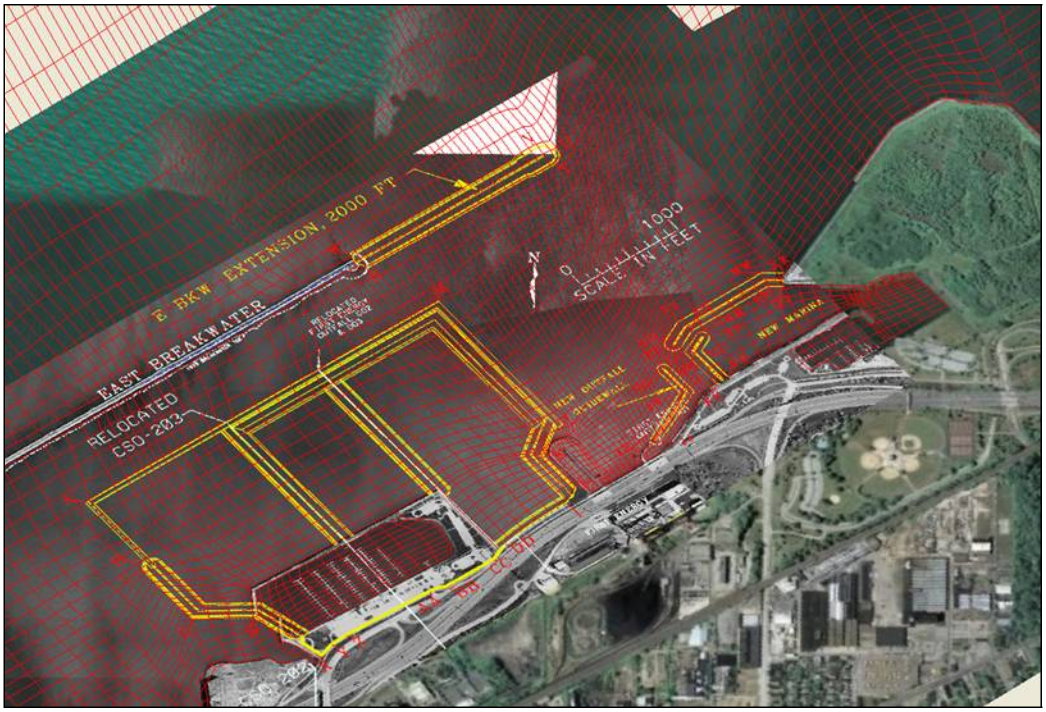


Figure 3-3. Near-field Cleveland Harbor CH3D grid with planned configuration options.

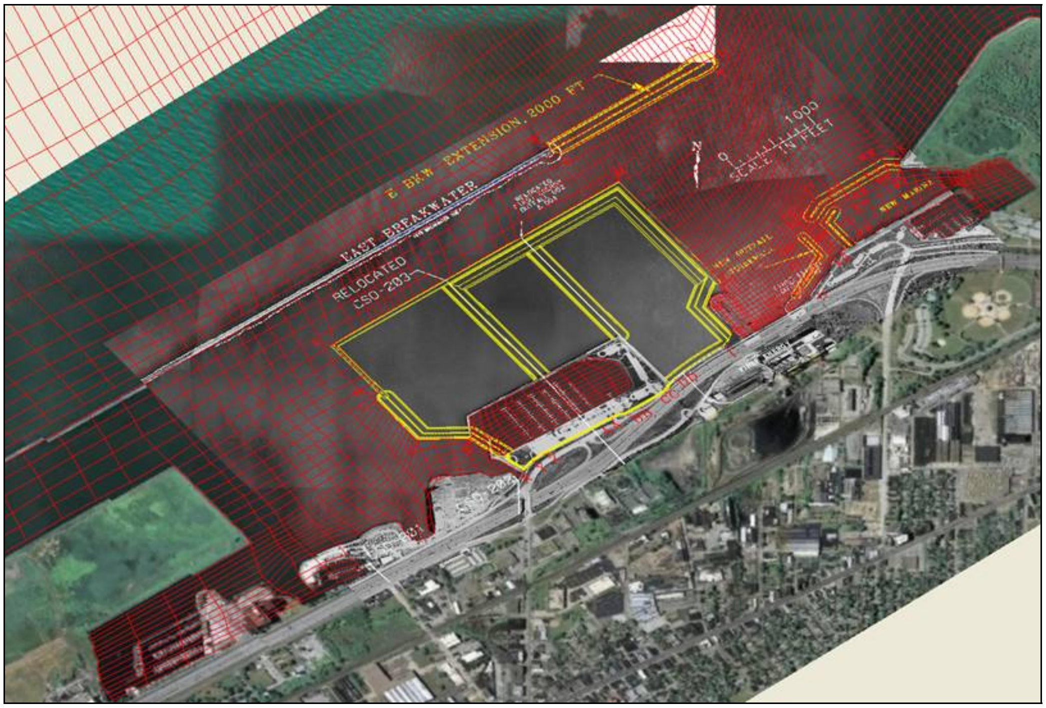


Figure 3-4. Near-field Cleveland Harbor CH3D Configuration 2 grid.

The physical boundaries and bathymetry defined within the CH3D grid were extracted from the ADCIRC grid, as described in the previous chapter. Boundary forcing utilized ADCIRC surface elevations at the open-water boundaries, spatially constant time-varying NDBC and Burke Airport wind components, USGS-measured Cuyahoga River flows, together with outfall and intake flow and temperature data measured at the 1st Energy Plant. In order to investigate variation in temperature distributions within Cleveland Harbor, the temperature of Lake Erie was initialized to 22^{o} C. Hydrodynamic and thermal distribution results were generated for the months of July and August, 2002 subsequent to a 15-day model spin-up period. The results of these simulations have been provided to the District in the form of AVI’s and Gulfview animation data along with the required programs to view the results. In addition to viewing temperature and velocity files, particles can be distributed interactively throughout the grid using Gulfview. Examination of the simulation animations illustrates the large variation in the circulation and thermal patterns. For example, Figure 3-5 is a Gulfview snapshot of the existing configuration temperature on 4 August 2002 when the wind was blowing from the east-northeast (Figure 3-6). As shown in Figure 3-5, significant recirculation of the thermal outfall discharge into cooling water intake occurs. The variation of temperature (Celsius) is shown in the bar scale at the bottom of Figure 3-5.

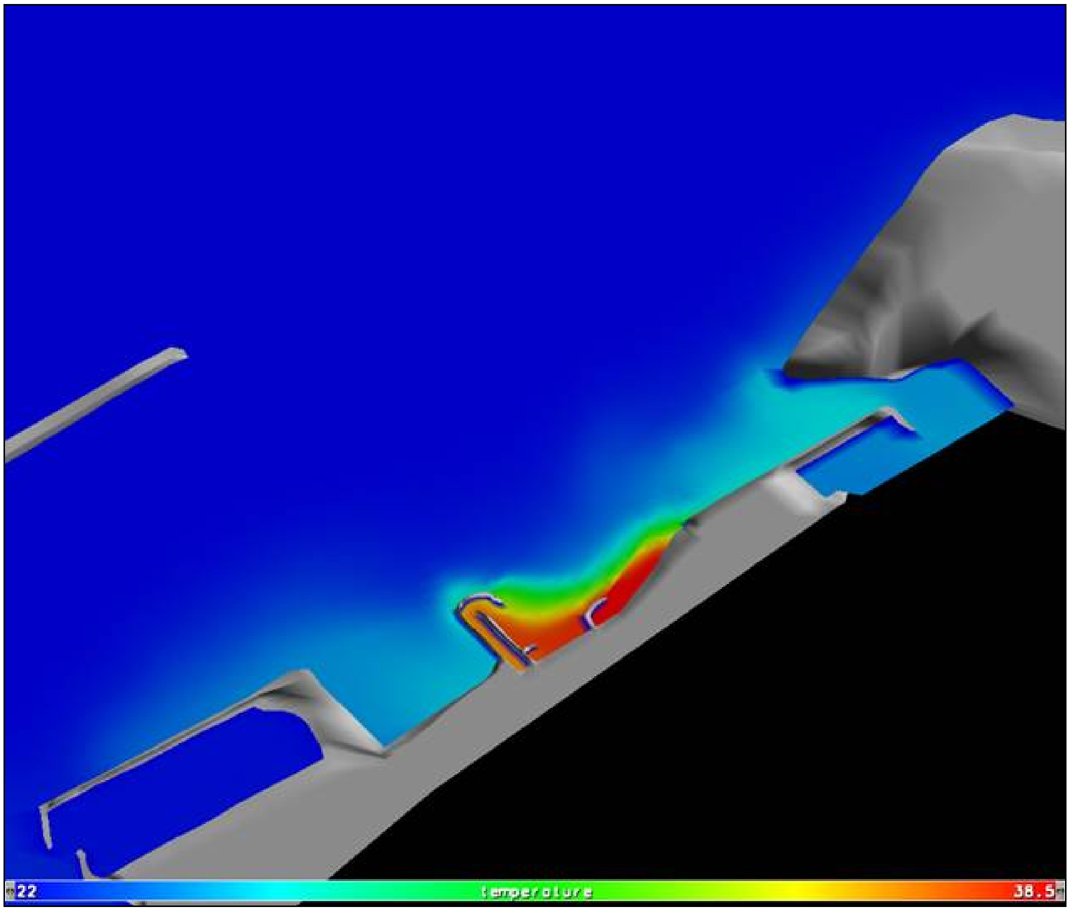


Figure 3-5. Gulfview snapshot of existing configuration temperature distribution during an easterly wind event (4 August 2002); Temperature in deg C.

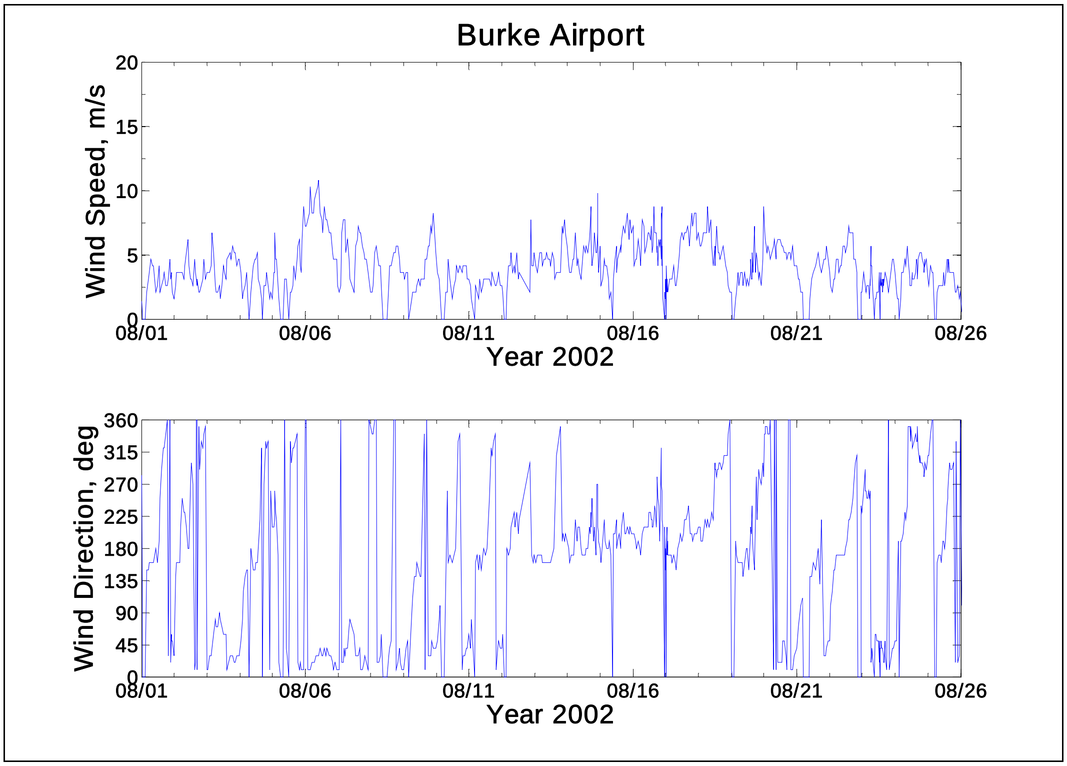


Figure 3-6. Time-series of wind speed and direction measured at Burke Airport.

A Gulfview snapshot corresponding to 25 August 2002, in which the wind had shifted to the northwest, is shown in Figure 3-7. It is seen that as the wind shifts westerly more of the thermal discharge energy is transported away from the intake structure resulting in lower intake temperatures.

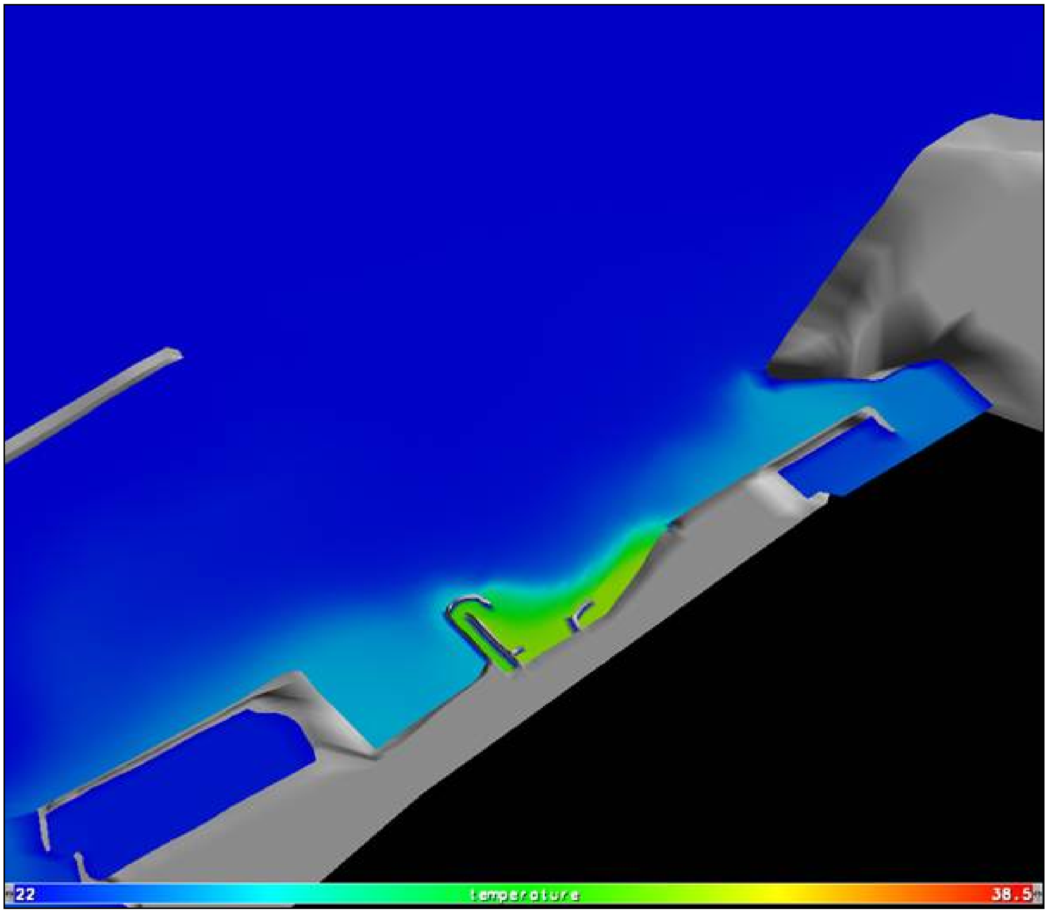


Figure 3-7. Gulfview snapshot of existing configuration temperature distribution during a westerly wind event (25 August 2002); Temperature in deg C.

A similar response is seen in Figures 3-8 and 3-9 where AVI snapshots are presented for the Base configuration and Configuration 2 during the 5 July northeasterly event, respectively. Winds recorded at Burke Airport for this period is presented in Figure 3-10. It is seen that the intake temperature exceeds 33^o C with northeasterly wind forcing and is less than 25^o C during southwesterly wind forcing. Further analysis of the influence of the CDF configuration on the harbor wide temperature distribution was pursued by developing temperature difference animations. The temperature difference animations were generated by subtracting the predicted base condition temperature throughout the grid from that of the three CDF configurations. Harbor temperatures are displayed in Figures 3-11 and 3-12 for the Base configuration and Configuration 2 during the 28 June southwesterly wind event. Figures 3-12 through 3-14 display the temperature differences between the Base and the 3 planned configurations.. These figures show that the maximum temperature increase associated with Configurations 1 and 2 is less that 4^o C, a minimal effect on the intake temperature and an increase of 2^o C within the Gordon Park Marina. Configuration 3, with the extended outfall guide wall and additional breakwaters, shows local temperature increases of 5^0 C and a 1^o C increase at the intake and in the Gordon Park Marina.

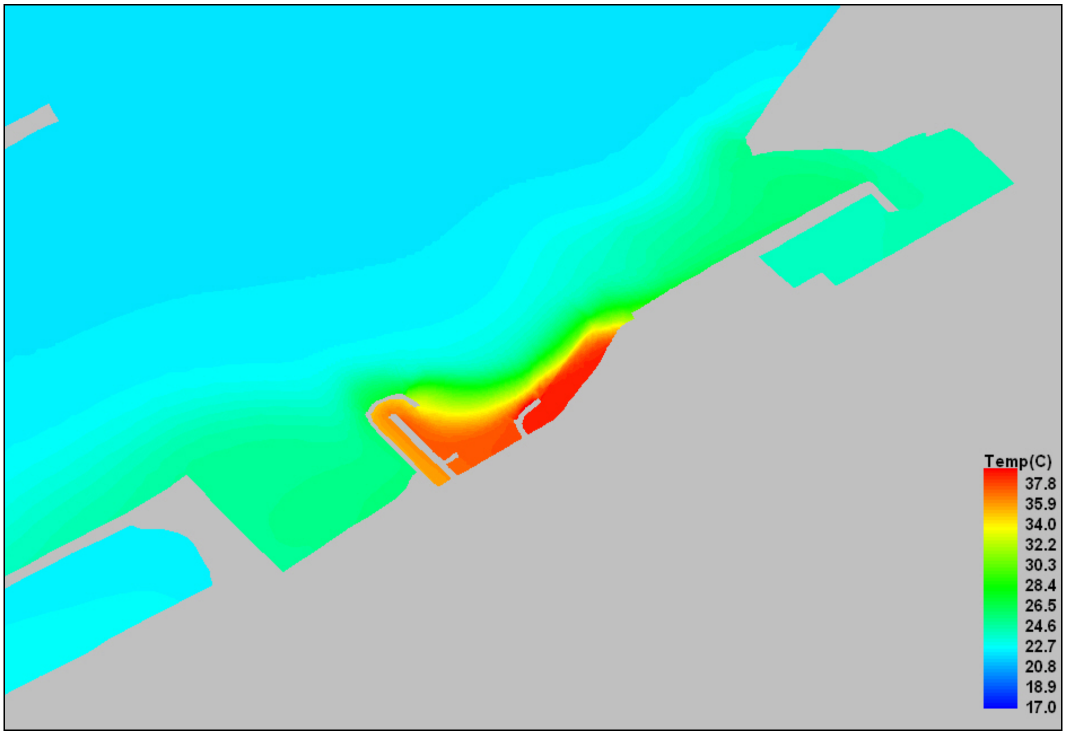


Figure 3-8. AVI snapshot of Base Configuration temperature during a northeasterly wind event (5 July 2002); Temperature in deg C.

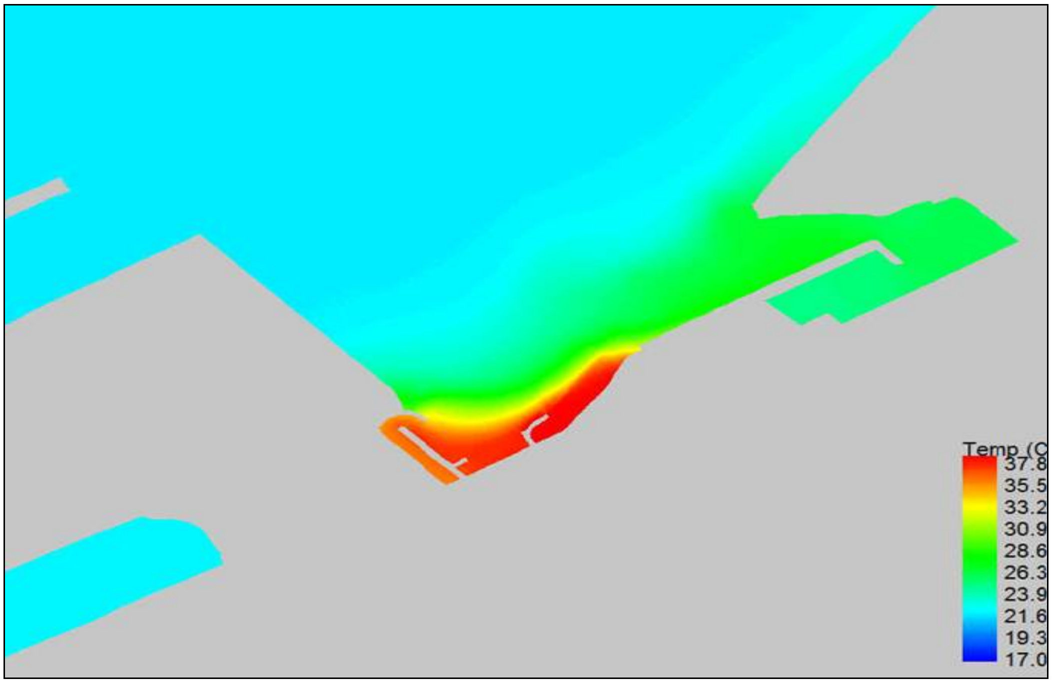


Figure 3-9. AVI snapshot of Configuration 2 temperature during a northeasterly wind event (5 July 2002); Temperature in deg C.

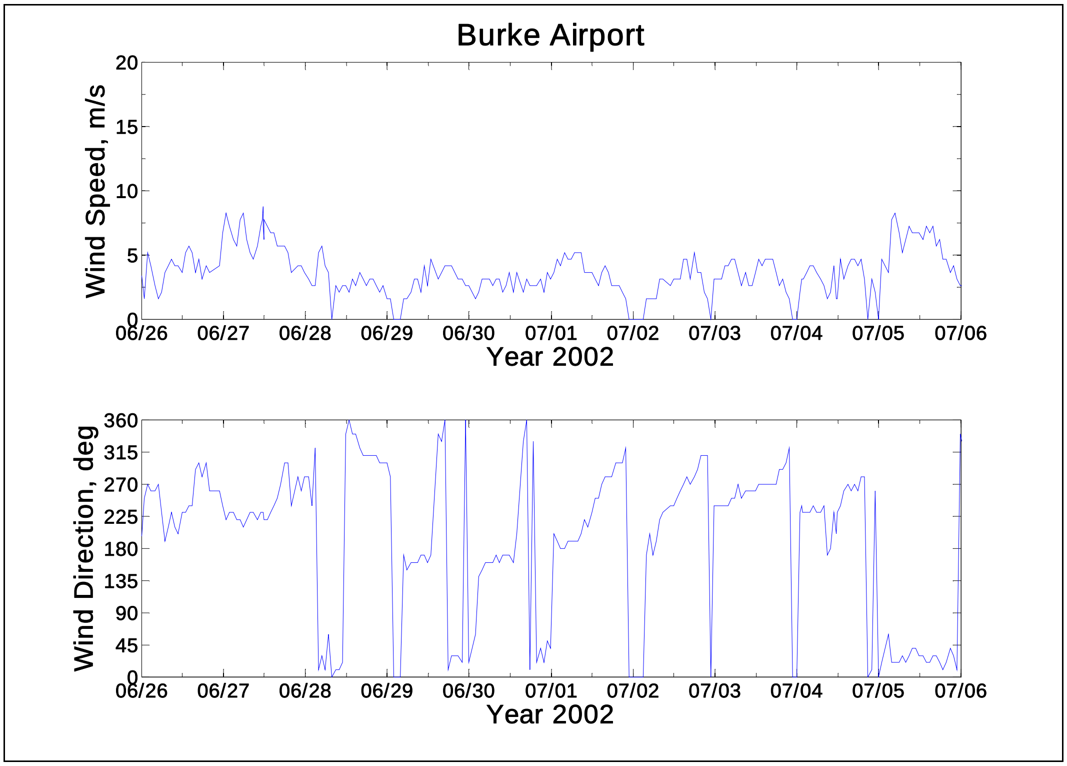


Figure 3-10. Time-series of wind speed and direction measured at Burke Airport.

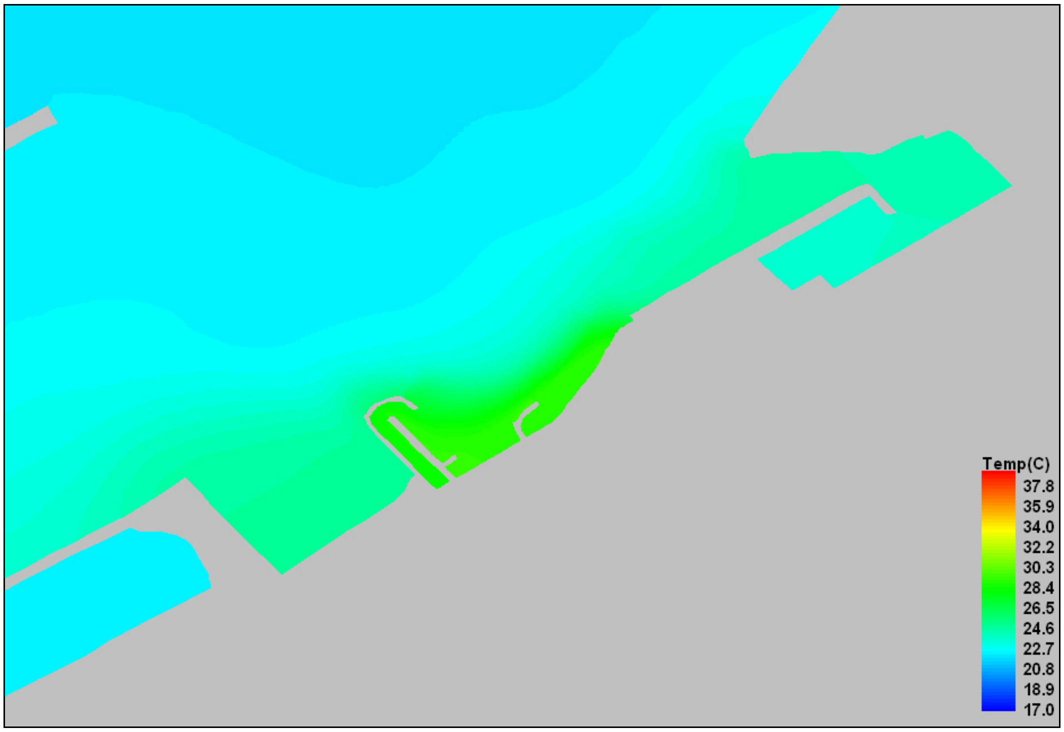


Figure 3-11. AVI snapshot of Base Configuration temperature during a southwesterly wind event (28 June 2002); Temperature in deg C.

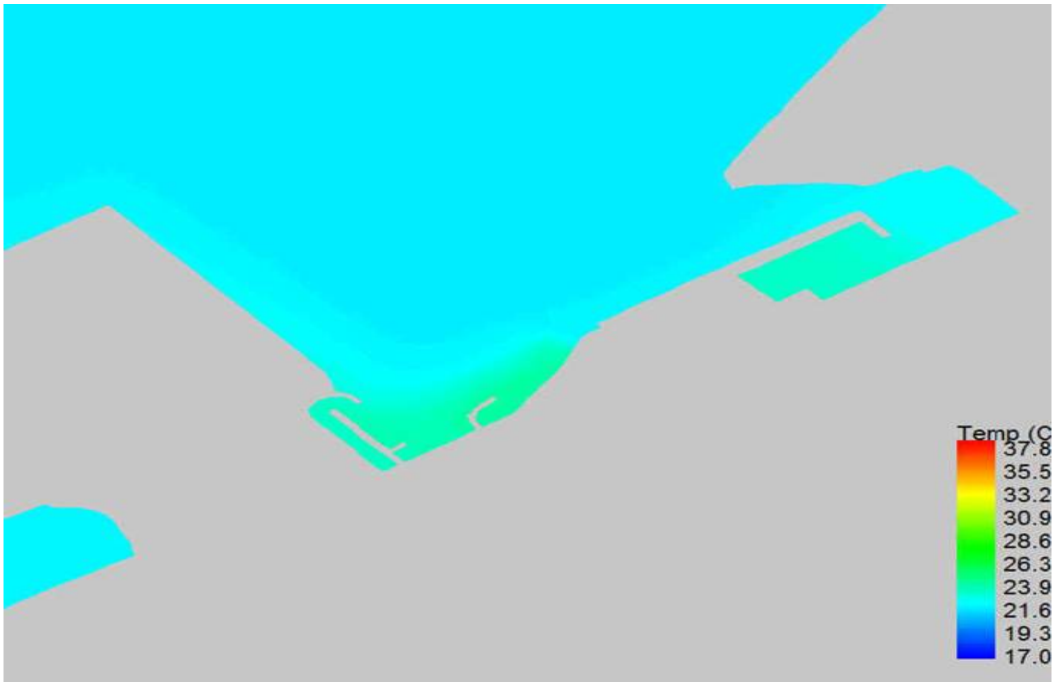


Figure 3-12. AVI snapshot of Configuration 2 temperature distribution during a southwesterly wind event (28 June 2002); Temperature in deg C.

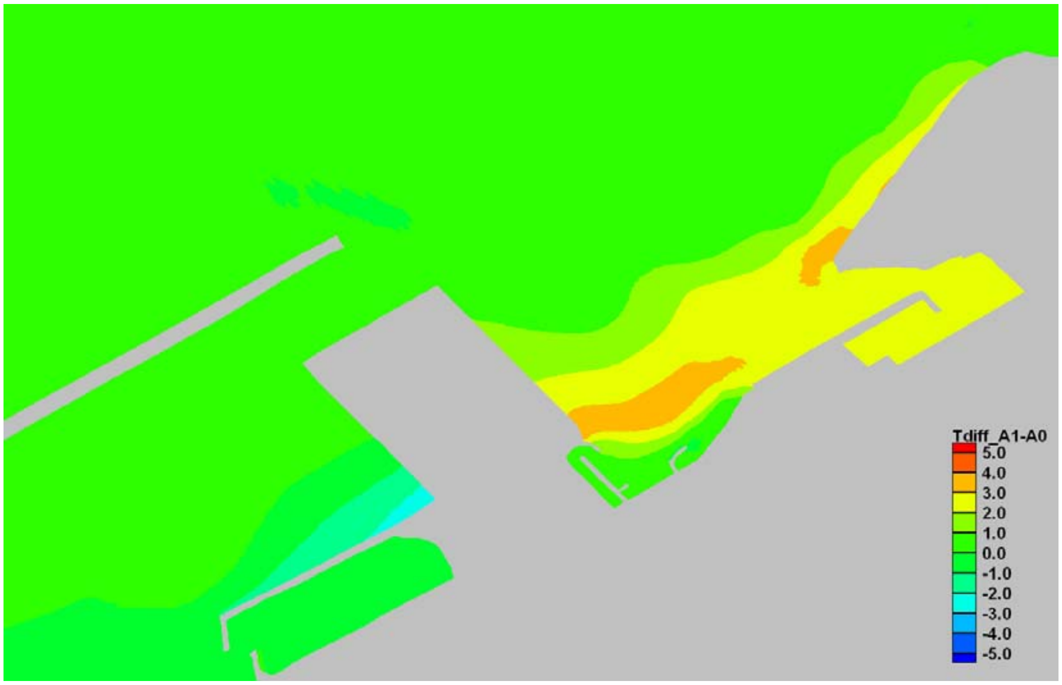


Figure 3-13. AVI snapshot of Configuration 1 temperature differences during a northeasterly wind event (5 July 2002); Temperature in deg C.

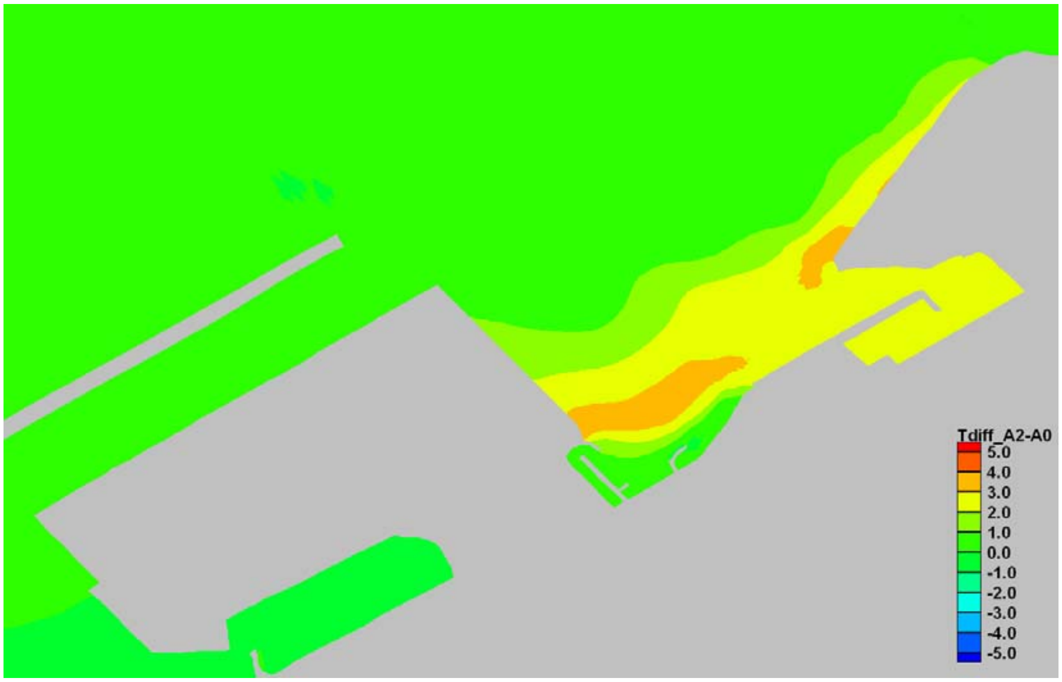


Figure 3-14. AVI snapshot of Configuration 2 temperature differences during a northeasterly wind event (5 July 2002); Temperature in deg C.

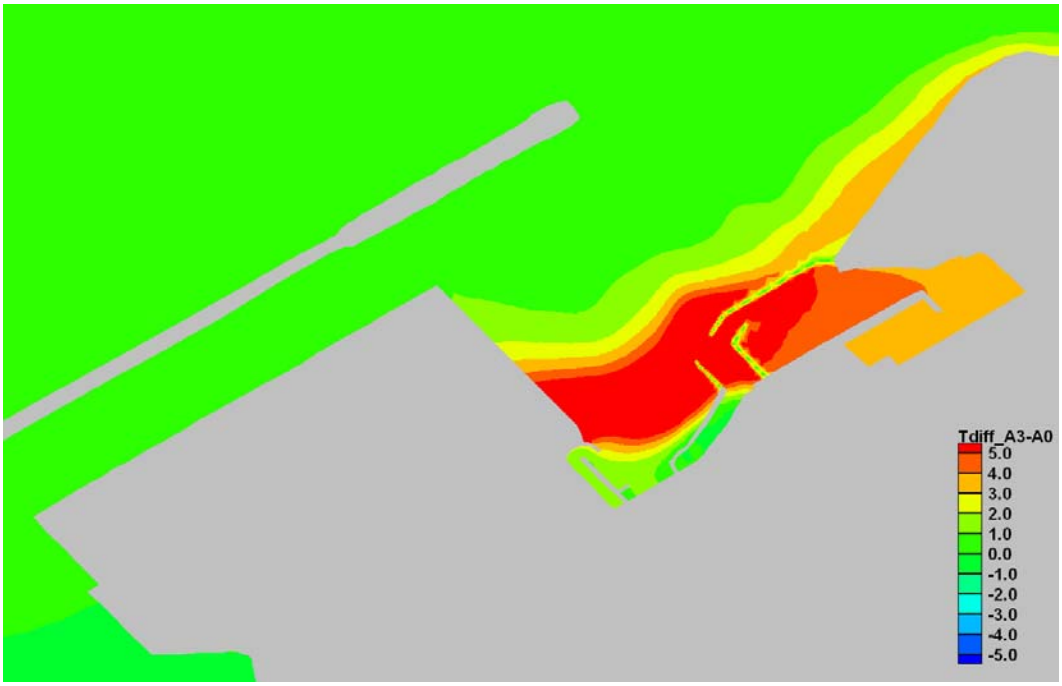


Figure 3-15. AVI snapshot of configuration 3 temperature differences during a northeasterly wind event (5 July 2002); Temperature in deg C.

Figure 3-15 displays the Harbor temperatures on 28 June during a southwesterly wind event for the base condition. Figures 3-16 through 3-18 display temperature differences for Configurations 1 through 3, respectively. These figures show that the maximum temperature increase associated with Configurations 1 and 2 are less that 3^{o} C and a minimal effect on the intake temperature. Configuration 3 results in a local temperature increased of 5^{0} C and about a 1^{o} C increase in temperature at the intake and in the Gordon Park Marina.

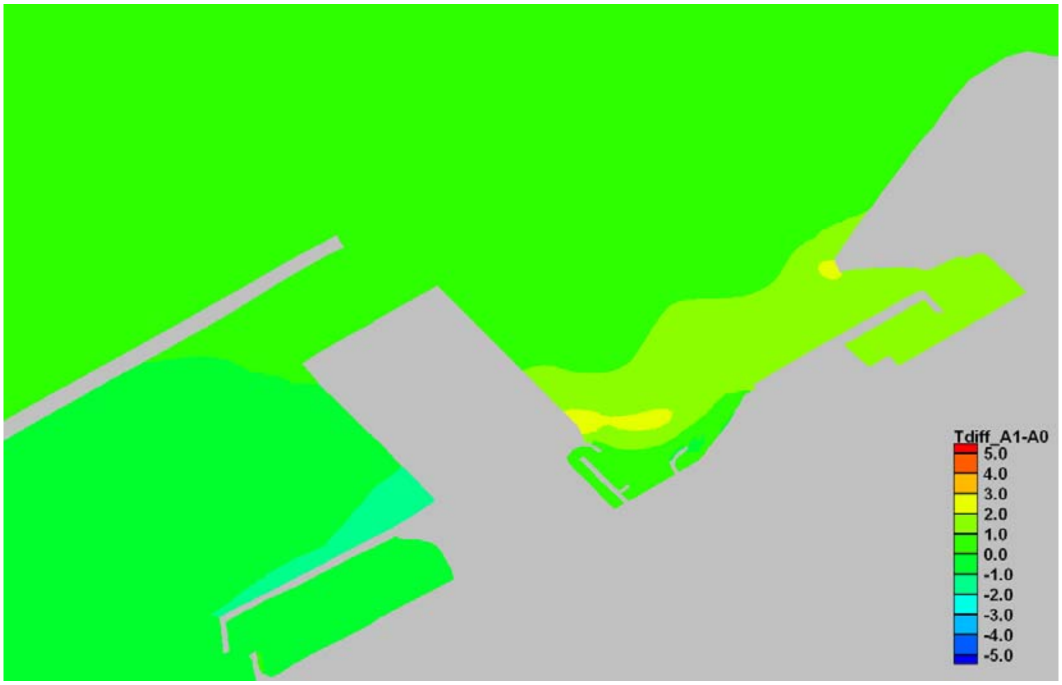


Figure 3-16. AVI snapshot of Configuration 1 temperature differences during a southwesterly wind event (28 June 2002); Temperature in deg C.

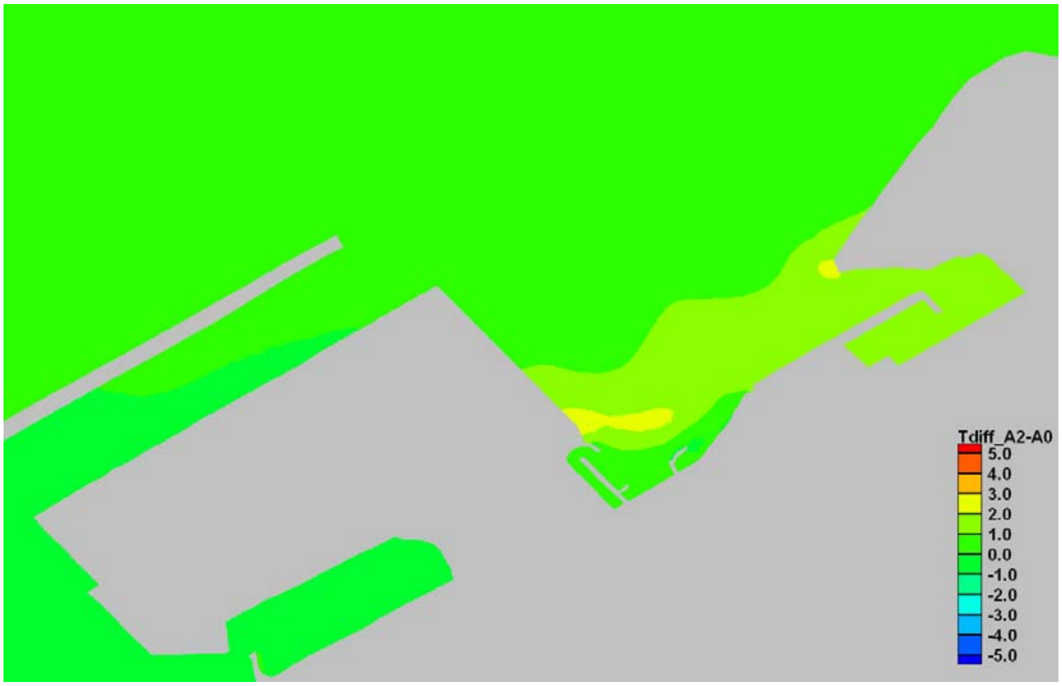


Figure 3-17. AVI snapshot of Configuration 2 temperature differences during a southwesterly wind event (28 June 2002); Temperature in deg C.

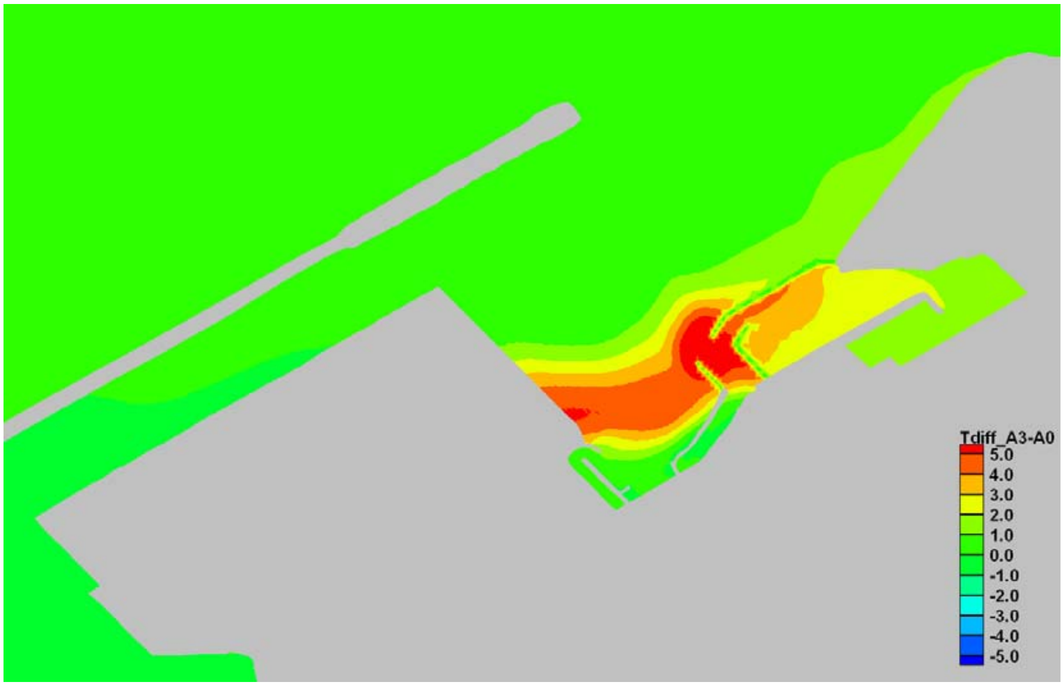


Figure 3-18. AVI snapshot of Configuration 3 temperature differences during a southwesterly wind event (28 June 2002); Temperature in deg C.

4 Summary

The U.S. Army District, Buffalo (LRB) plans to construct a Confined Disposal Facility (CDF) within Cleveland Harbor. One potential site is located at the eastern entrance to the Harbor. However, this site is located in close proximity to the cooling water intake and outfall structures servicing the First Energy Power Plant. Concern exists that the planned CDF will change the circulation pattern in the Harbor area such that water discharge from the power plant will be subsequently drawn into the intake without adequate cooling.

Potential adverse impacts due to the proposed CDF, reported herein, were determined by examining changes in model-generated current circulation and thermal transport patterns. ADCIRC modeling efforts concentrated on quantifying the change in circulation patterns with and without the CDF in place for storm and quiescent/non-storm conditions. For evaluating changes in the thermal plume transport, the two-month CH3D simulation period of July and August 2002 was chosen because the relatively weak winds experienced during summer limit mixing of the plume with Lake waters, the worst-case scenario.

A two-dimensional, depth-averaged, version of the hydrodynamic model ADCIRC was applied in this study. This model required grid development and calibration/validation of the bathymetric grid to wind forcing. For the model calibration and validation, ADCIRC results were compared with 12 NOS and the CMEDS water level gauges throughout Lake Erie. The calculated water levels from the ADCIRC simulation compared well in range and phase with the NOS gauge measurements considering that the locations of the eastern gauges were well outside the area of high resolution in the project area.

Under easterly wind conditions, each CDF will increase peak storm-induced westerly currents within the channel from about 0.05 m/s to approximately 0.4 m/s. The stronger currents induced by the planned CDFs are attributed to the reduced cross-sectional area within the channel.

Current in Gordon Park Marina can be characterized as weak, and the planned configurations do not appear to have an appreciable impact on current strength in the marina. Current at the East 55th Street Marina entrance can, also, be characterized as weak. For this marina, the change in current strength is attributed to the sheltering caused by the planned configurations. These observations should not be construed that the CDFs will have no impact on flushing rates in this marina or that the planned construction will not degrade water quality. To make these determinations, a particle-tracking or water-quality model, which account for transport and flux of material within the Harbor system will need to be used. Furthermore, potential issues relating to possible erosion or to wave-induced resonance induced by constructing the CDF were investigated.

The CH3D hydrodynamic and thermal transport model was applied to investigate the effect of the three alternative CDF configurations on the heated water discharge temperature distribution within Cleveland Harbor. The third configuration included a breakwater extension, relocation of E55th St. Marina and lengthening of the First Energy guide wall. For each of the three alternative CDF configurations, the spatial distribution of the thermal plume is shown to be primarily influenced by wind direction and speed, and temperature at the intake and can vary significantly depending on the prevailing wind conditions. However, there is minimal temperature change between the base configuration and the three plan configurations. (In addition to this report, the District has been provided the data and software to examine animations of the thermal simulation results.)

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Appendix A
Description of the ADCIRC Model

The ADvanced CIRCulation (ADCIRC) numerical model was chosen for simulating the long-wave hydrodynamic processes in Lake Erie. Imposing wind fields extracted from the National Center for Environmental Prediction database, or wind and atmospheric pressure fields computed with the PBL model, the ADCIRC model can accurately replicate tidally-driven currents and hurricane-induced storm-surge levels. The ADCIRC model was developed in the USACE Dredging Research Program (DRP) as a family of two- and three-dimensional finite element-based models (Luettich, Westerink, and Scheffner 1992; Westerink et al. 1992). Model attributes include the following capabilities:

a. Simulating tidal circulation and storm-surge propagation over very large computational domains while simultaneously providing high resolution in areas of complex shoreline configuration and bathymetry. The targeted areas of interest include continental shelves, nearshore areas, and estuaries.

b. Representing properly all pertinent physics of the three-dimensional equations of motion. These include tidal potential, Coriolis, and all nonlinear terms of the governing equations.

c. Providing accurate and efficient computations over time periods ranging from months to years.

In two dimensions, the model is formulated using the depth-averaged shallow water equations for conservation of mass and momentum. Furthermore, the formulation assumes that the water is incompressible, that hydrostatic pressure conditions exist, and that the Boussinesq approximation is valid. Using the standard quadratic parameterization for bottom stress and neglecting baroclinic terms and lateral diffusion/dispersion effects, the following set of conservation equations in primitive, nonconservative form, and expressed in a spherical coordinate system, are incorporated in the model (Flather 1988; Kolar et al. 1993):

$$\frac{\partial U}{\partial t} + \frac{1}{r \cos\phi} U \frac{\partial U}{\partial \lambda} + \frac{1}{R} V \frac{\partial U}{\partial \phi} - \left[\frac{\tan\phi}{R} U + f \right] V = \qquad \text{(A-1)}$$

$$-\frac{1}{R\cos\phi}\frac{\partial}{\partial\lambda}\left[\frac{p_s}{\rho_0}+g(\zeta-\eta)\right]+\frac{\tau_{s\lambda}}{\rho_0 H}-\tau_* U$$

$$\frac{\partial V}{\partial t}+\frac{1}{r\cos\phi}U\frac{\partial V}{\partial\lambda}+\frac{1}{R}V\frac{\partial V}{\partial\phi}-\left[\frac{\tan\phi}{R}U+f\right]U= \tag{A-2}$$

$$-\frac{1}{R}\frac{\partial}{\partial\phi}\left[\frac{p_s}{\rho_0}+g(\zeta-\eta)\right]+\frac{\tau_{s\lambda}}{\rho_0 H}-\tau_* V$$

$$\frac{\partial\zeta}{\partial t}+\frac{1}{R\cos\phi}\left[\frac{\partial UH}{\partial\lambda}+\frac{\partial(UV\cos\phi}{\partial\phi}\right] \tag{A-3}$$

where

t = time

λ and φ = degrees longitude (east of Greenwich is taken positive) and degrees latitude (north of the equator is taken positive)

ζ = free surface elevation relative to the geoid

U and V = depth-averaged horizontal velocities in the longitudinal and latitudinal directions, respectively

R = the radius of the Earth

$H = \zeta + h$ = total water column depth

h = bathymetric depth relative to the geoid

$f = 2\Omega \sin \varphi$ = Coriolis parameter

Ω = angular speed of the Earth

p_s = atmospheric pressure at free surface

g = acceleration due to gravity

η = effective Newtonian equilibrium tide-generating potential parameter

ρ_0 = reference density of water

$\tau_{s\lambda}$ and $\tau_{s\varphi}$ = applied free surface stresses in the longitudinal and latitudinal directions, respectively

τ = bottom shear stress and is given by the expression $C_f(U^2 + V^2)^{1/2}/H$ where
C_f = the bottom friction coefficient

The momentum equations (Equations 1 and 2) are differentiated with respect to λ and τ and substituted into the time differentiated continuity equation (Equation 3) to develop the following Generalized Wave Continuity Equation (GWCE):

$$\frac{\partial^2\zeta}{\partial t^2} + \tau_0\frac{\partial\zeta}{\partial t} - \frac{1}{R\cos\phi}\frac{\partial}{\partial\lambda}\left[\frac{1}{R\cos\phi}\left(\frac{\partial HUU}{\partial\lambda} + \frac{\partial(HUV\cos\phi}{\partial\phi}\right) - UVH\frac{\tan\phi}{R}\right]$$

$$\left[-2\omega\sin\phi\, HV + \frac{H}{R\cos\phi}\frac{\partial}{\partial\lambda}\left(g(\zeta - \alpha\eta) + \frac{p_5}{[}p_0\right) + \tau_* HU - \tau_0 HU - \tau_{s\lambda}\right]$$

$$-\frac{1}{R}\frac{\partial}{\partial\phi}\left[\frac{1}{R\cos\phi}\left(\frac{\partial HVV}{\partial\lambda} + \frac{\partial HVV\cos\phi}{\partial\phi}\right) + UUH\frac{\tan\phi}{R} + 2\,\omega\sin\phi\, HU\right] \quad \text{(A-4)}$$

$$+\frac{H}{R}\frac{\partial}{\partial\phi}\left(g(\zeta - alfa\eta) + \frac{p_s}{\rho_0}\right) + \tau_* - \tau_0 HV - \frac{\tau_{s\lambda}}{\rho_0}]$$

$$-\frac{\partial}{\partial t}[\frac{VH}{R}\tan\phi] - \tau_0[\frac{VH}{R}\tan\phi] = 0$$

The ADCIRC-2DDI model solves the GWCE in conjunction with the primitive momentum equations given in Equations 1 and 2. The GWCE-based solution scheme eliminates several problems associated with finite-element programs that solve the primitive forms of the continuity and momentum equations, including spurious modes of oscillation and artificial damping of the tidal signal. Forcing functions include time-varying water-surface elevations, wind shear stresses, atmospheric pressure gradients, and the Coriolis effect. Also, the study area can be described in ADCIRC using either a Cartesian (i.e., flat earth) or spherical coordinate system.

The ADCIRC model uses a finite-element algorithm in solving the defined governing equations over complicated bathymetry encompassed by irregular sea/ shore boundaries. This algorithm allows for extremely flexible spatial discretizations over the entire computational domain and has demonstrated excellent stability characteristics. The advantage of this flexibility in developing a computational grid is that larger elements can be used in open-ocean regions where less resolution is needed, whereas smaller elements can be applied in the nearshore and estuary areas where finer resolution is required to resolve hydrodynamic details.

Appendix B
Description of the Three-Dimensional Circulation Model (CH3D)

A general overview of the sigma-stretched CH3D model background is provided with emphasis on the pertinent details for application of the model for this study. Much of the model background is extracted from the model user's guide (Chapman et. al. 1996), and the reader is referred to this document for additional details about the model.

CH3D was developed by Sheng (1986), but has been modified to implement different basic numerical formulations of the governing equations and to provide more efficient computing. A description of modifications to the model is provided in Chapman et al. (1996). Physical processes impacting circulation and vertical mixing that are modeled include tides, wind, density effects (salinity and temperature), freshwater inflows, turbulence, and the effect of the earth's rotation.

The boundary-fitted coordinate feature of the model provides grid resolution enhancement necessary to adequately represent deep navigation channels and irregular shoreline configurations of the flow system, important factors for the present study. The curvilinear grid also permits adoption of accurate and economical grid schematization software. The solution algorithm employs an external mode, consisting of vertically averaged equations, which provides a solution for the free surface displacement for input to the internal mode, which contains the full 3D equations.

Governing equations

The governing partial differential equations are based on the following assumptions: a) the hydrostatic pressure distribution adequately describes the vertical distribution of fluid pressure; b) the Boussinesq approximation is appropriate; c) the eddy viscosity approach adequately describes turbulent mixing in the flow.

The basic equations for an incompressible fluid in a right-handed Cartesian coordinate system (x,y,z) are (Johnson et al., 1991b):

$$\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}+\frac{\partial w}{\partial z}=0 \tag{B-1}$$

$$\frac{\partial u}{dt}+\frac{\partial u^2}{dx}+\frac{\partial uv}{\partial y}+\frac{\partial uw}{\partial z}=fv-\frac{1}{\rho_o}\frac{\partial p}{\partial x}+\frac{\partial}{\partial x}\left(A_h\frac{\partial u}{\partial x}\right)+\frac{\partial}{\partial y}\left(A_h\frac{\partial u}{\partial y}\right)+\frac{\partial}{\partial z}\left(A_v\frac{\partial u}{\partial z}\right) \tag{B-2}$$

$$\frac{\partial u}{\partial t}+\frac{\partial uv}{\partial x}+\frac{\partial v^2}{\partial y}+\frac{\partial vw}{\partial z}=-fu-\frac{1}{\rho_\mathrm{o}}\frac{\partial p}{\partial y}+\frac{\partial}{\partial x}\left(A_h\frac{\partial v}{\partial x}\right)+\frac{\partial}{\partial y}\left(A_h\frac{\partial v}{\partial y}\right)+\frac{\partial}{\partial z}\left(\mathrm{A_v}\frac{\partial v}{\partial z}\right) \tag{B-3}$$

$$\frac{\partial p}{\partial z}=-\rho g \tag{B-4}$$

$$\frac{\partial T}{\partial t}+\frac{\partial uT}{\partial x}+\frac{\partial vT}{\partial y}+\frac{\partial wT}{\partial z}=\frac{\partial}{\partial x}\left(K_h\frac{\partial T}{\partial x}\right)+\frac{\partial}{\partial y}\left(K_h\frac{\partial T}{\partial y}\right)+\frac{\partial}{\partial z}\left(K_v\frac{\partial T}{\partial z}\right) \tag{B-5}$$

$$\frac{\partial S}{\partial t}+\frac{\partial uS}{\partial x}+\frac{\partial vS}{\partial y}+\frac{\partial wS}{\partial z}=\frac{\partial}{\partial x}\left(K_h\frac{\partial S}{\partial x}\right)+\frac{\partial}{\partial y}\left(K_h\frac{\partial S}{\partial y}\right)+\frac{\partial}{\partial z}\left(K_v\frac{\partial S}{\partial z}\right) \tag{B-6}$$

$$\rho=\rho\,(T,S) \tag{B-7}$$

where

(u,v,w) = velocities in (x,y,z) directions

t = time

f = Coriolis parameter defined as $2\Omega \sin \varphi$

where

Ω = rotational speed of the earth

φ = latitude

ρ = density

p = pressure

A_h, K_h = horizontal turbulent eddy coefficients

A_v , K_v = vertical turbulent eddy coefficients

g = gravitational acceleration

T = temperature

S = salinity

Equation 4 implies that vertical accelerations are negligible and thus the pressure is hydrostatic. Various forms of the equation of state can be specified for Equation 7. In the present model, the formulation given below is used:

$$\rho = P/(\alpha + 0.698P) \tag{B-8}$$

where

ρ = density in grams per cubic centimeter

$$P = 5890 + 38T - 0.375T^2 + 3S$$

$$\alpha = 1779.5 + 11.25T - 0.0745T^2 - (3.8 + 0.01T)S$$

and *T* is temperature in degrees Celsius and *S* is salinity in parts per thousand (ppt).

Within the model, the basic equations presented above are normalized, boundary-fitted, and sigma-stretched as presented in Chapman et al. (1996).

Boundary Conditions

The governing equations presented above are subject to boundary conditions at the surface, bottom and lateral boundaries. These boundary conditions are discussed generally here and the reader is again referenced to Chapman, Johnson, and Vemulakonda (1996) for additional details.

The free-surface boundary condition is affected primarily by wind stresses and heat exchange. Wind stresses enter as source terms into the momentum equations (Equations 5-2 and 5-3) for the top layer in the following form:

$$\mathrm{A_v}\left(\frac{\partial \bar{\mathrm{u}}}{\partial \mathrm{z}}, \frac{\partial \bar{\mathrm{v}}}{\partial \mathrm{z}}\right) = \left(\tau_{\mathrm{s}_\xi}, \tau_{\mathrm{s}_\eta}\right)/\rho = \left(\mathrm{C\,W}_\xi^2, \mathrm{C\,W}_\eta^2\right) \tag{B-9}$$

where

τ_s = wind shear stress

C = surface drag coefficient

W = wind speed (m/s)

The surface drag coefficient is calculated by the method of Garratt (1977) as follows:

$$C = (0.75 + 0.067\ W) \text{ x } 10^{-3} \qquad \text{(B-10)}$$

Heat exchange at the surface is represented through a surface heat exchange coefficient and the daily equilibrium temperature and enters as a source term in Equation 5-5. The surface heat exchange coefficient and equilibrium temperature are calculated from geographical and meteorological conditions (latitude, wind speed, cloud cover, and wet and dry bulb temperatures). Zero salinity flux is imposed in the surface layer.

The bottom boundary condition is primarily influenced by bottom friction, expressed in the governing equations for the bottom layer as:

$$A_v \left(\frac{\partial \overline{u}}{\partial z}, \frac{\partial \overline{v}}{\partial z} \right) = \left(\tau_{b_\xi}, \tau_{b_\eta} \right) / \rho \ = \frac{U_r}{A_{vr}} Z_r C_d \left(\overline{u}_1^2 + \overline{v}_1^2 \right)^{1/2} \left(\overline{u}_1, \overline{v}_1 \right) \qquad \text{(B-11)}$$

where

τ_b = bottom shear stress

U_r = reference velocity

Z_r = reference height

C_d = bottom drag coefficient

u_1, v_1 = near-bottom horizontal velocity

Bottom friction can be specified by a variety of methods. The bottom friction for the present study was specified as a spatially constant bottom friction coefficient, and values applied are discussed with model calibration. Other bottom boundary conditions imposed by the model include zero temperature and salinity fluxes.

Open-water boundaries include specification of water-surface elevation and temperature. River boundaries are prescribed as input flow and temperature.

Appendix C
ADCIRC Calibration and Validation Results

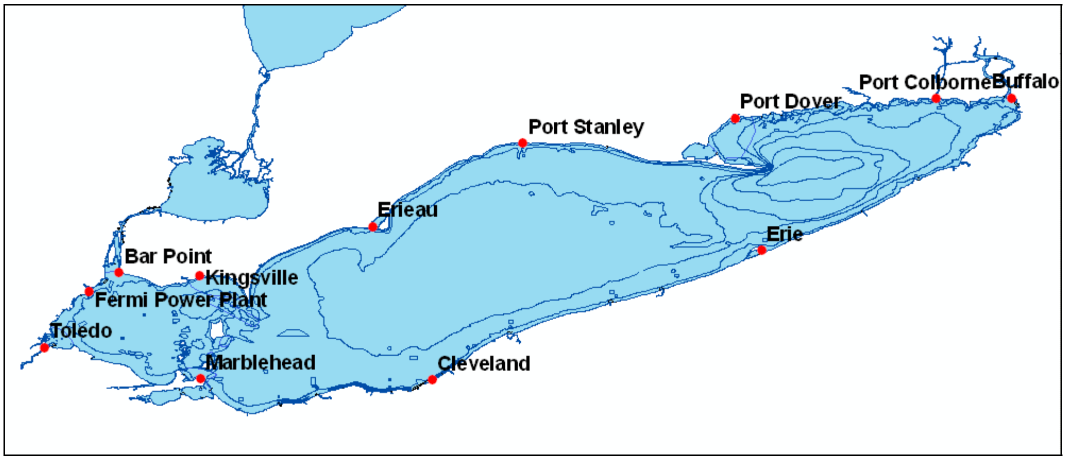


Figure C1. Gauge Locations used in Calibration and Validation Exercises.

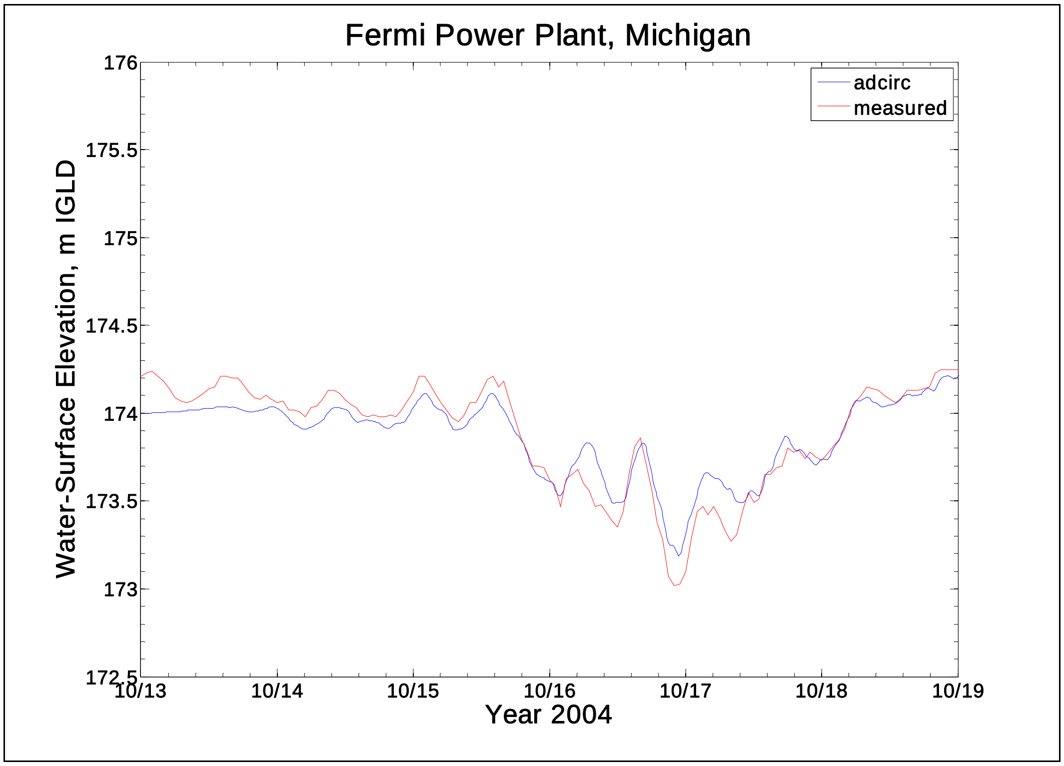


Figure C2. Comparison of model-generated and measured water-surface elevations: Fermi Power Plant, MI, 13-19 Oct 2004.

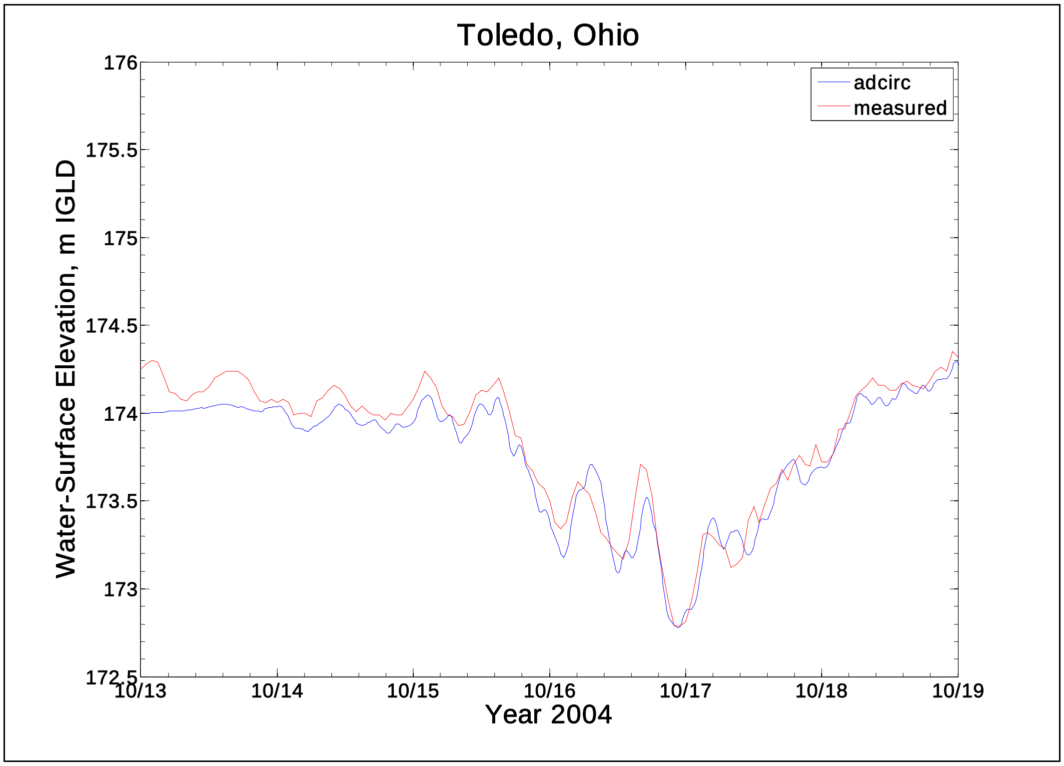


Figure C3. Comparison of model-generated and measured water-surface elevations: Toledo, OH, 13-19 Oct 2004.

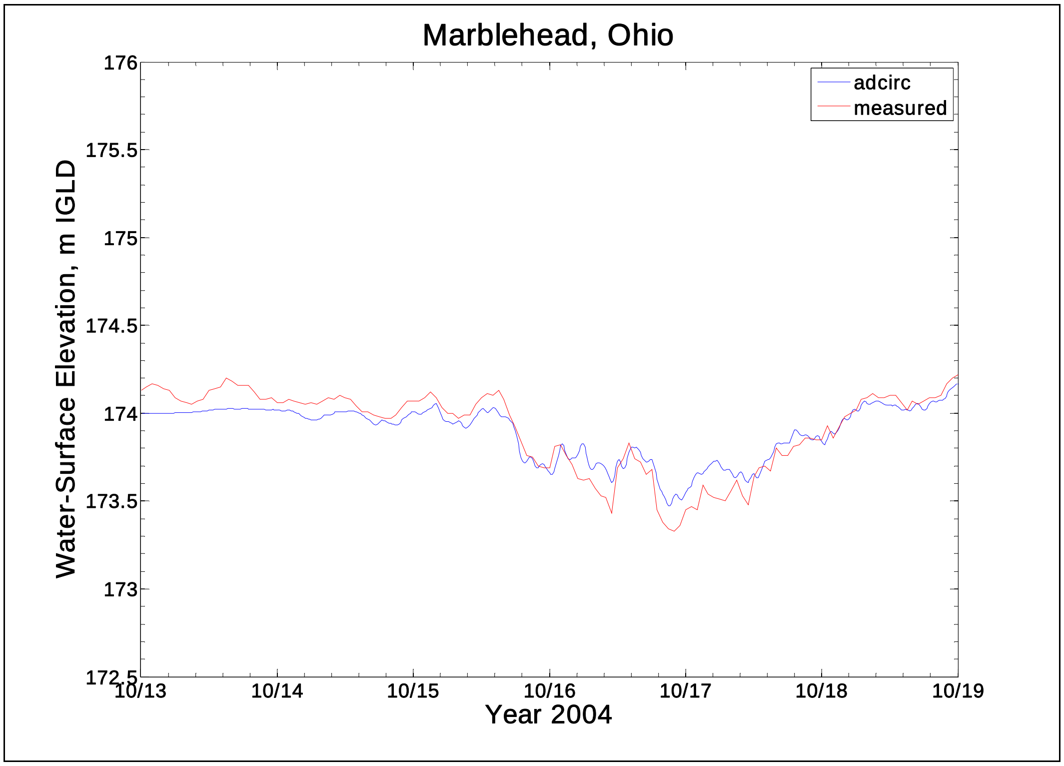


Figure C4. Comparison of model-generated and measured water-surface elevations: Marblehead, OH, 13-19 Oct 2004.

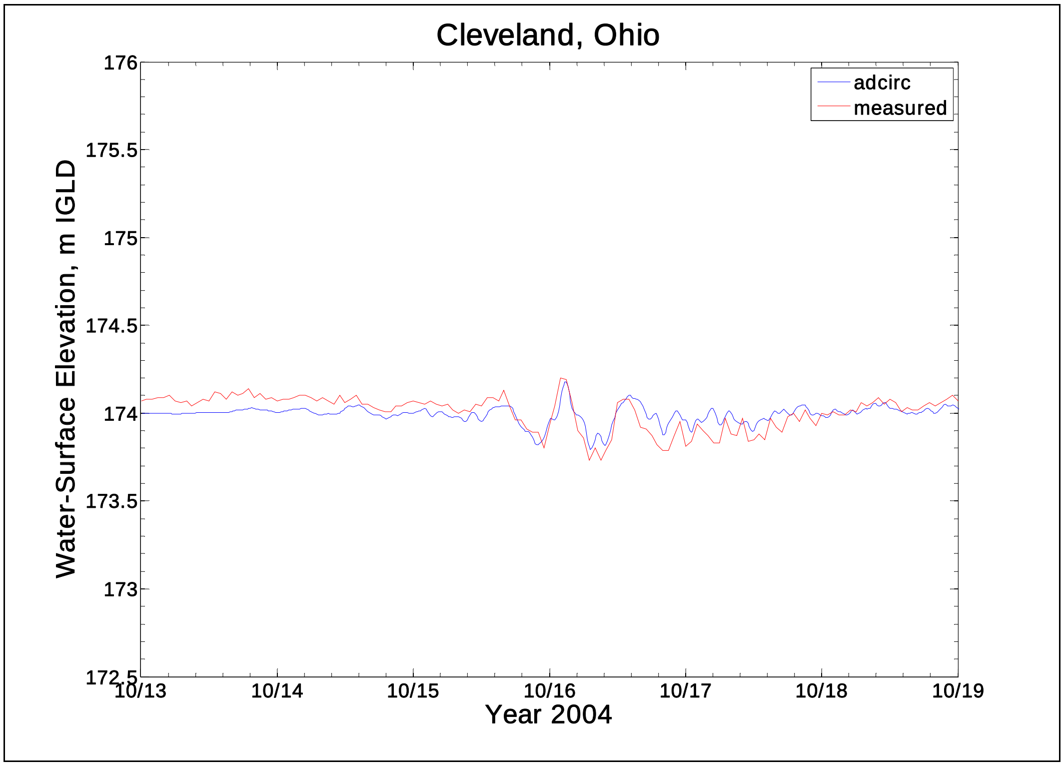


Figure C5. Comparison of model-generated and measured water-surface elevations: Cleveland, OH, 13-19 Oct 2004.

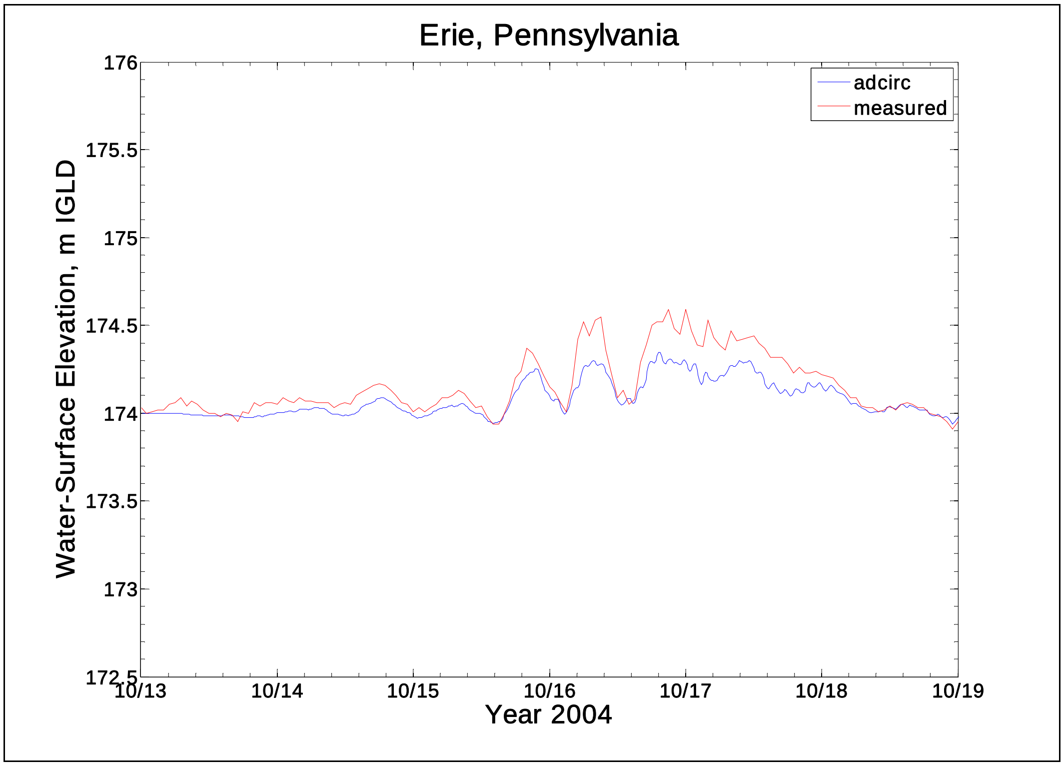


Figure C6. Comparison of model-generated and measured water-surface elevations: Erie, PA, 13-19 Oct 2004.

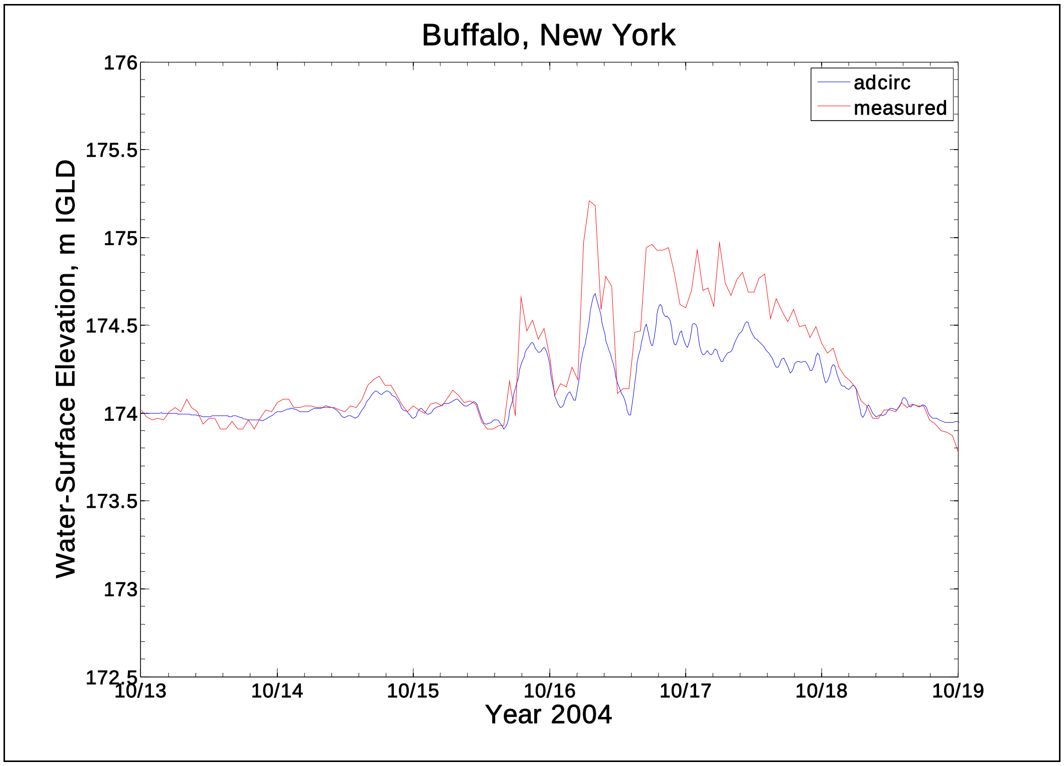


Figure C7. Comparison of model-generated and measured water-surface elevations: Buffalo, NY, 13-19 Oct 2004.

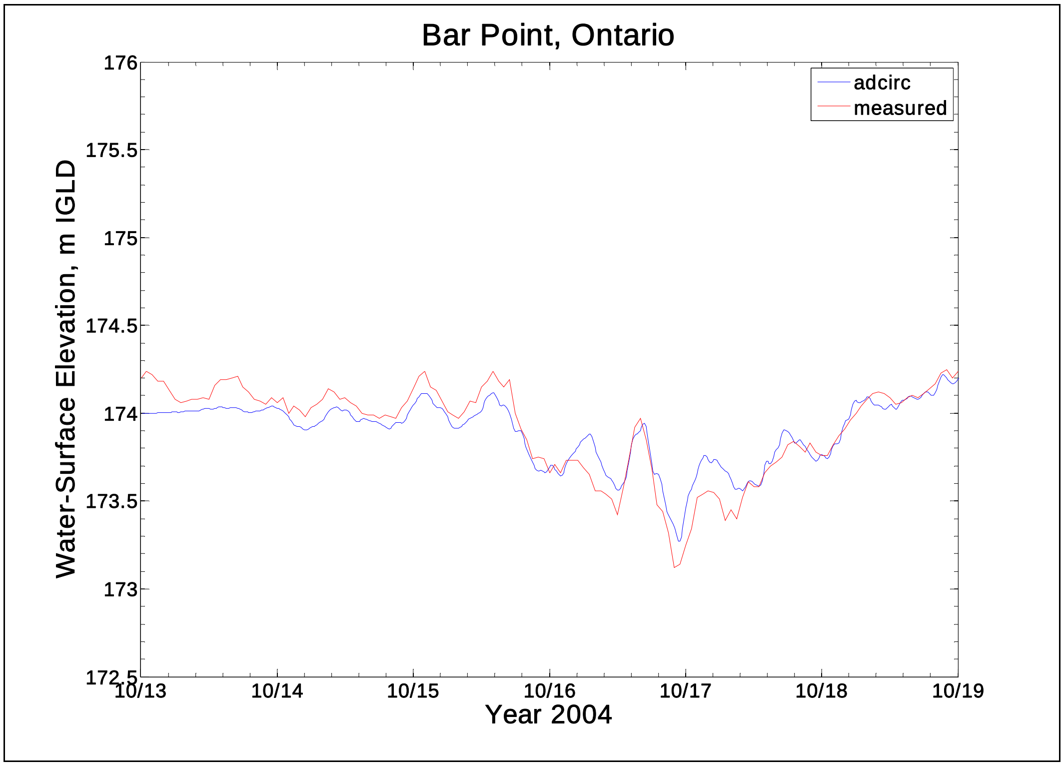


Figure C8. Comparison of model-generated and measured water-surface elevations: Bar Point, Ontario, 13-19 Oct 2004.

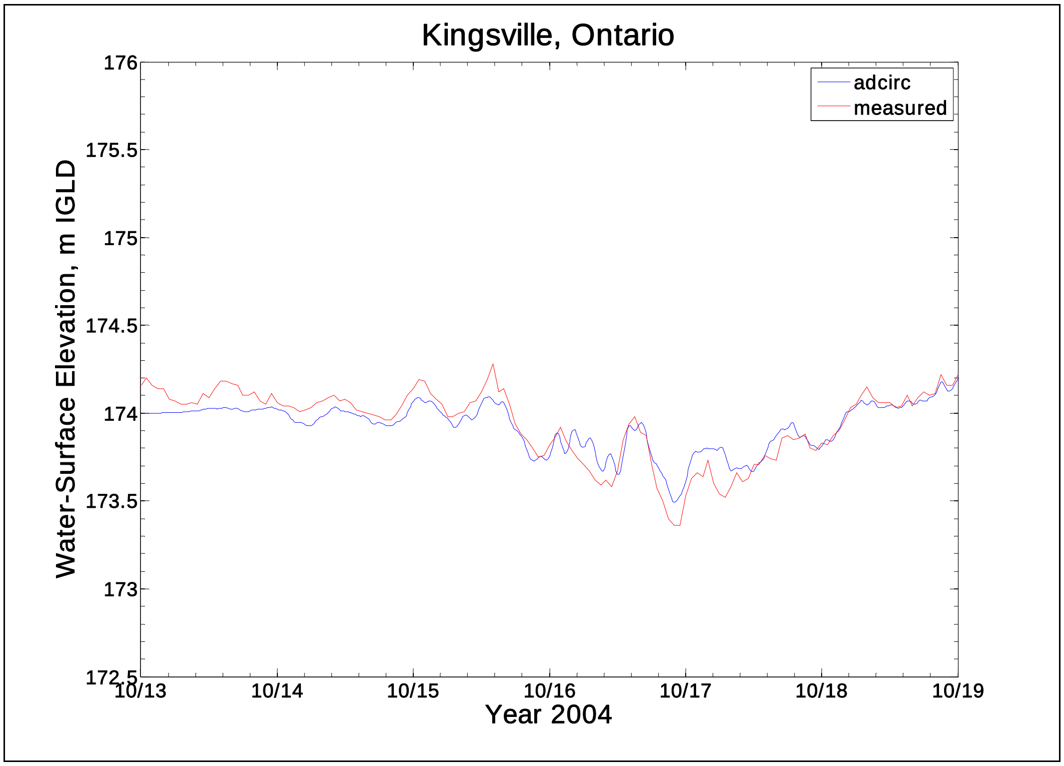


Figure C9. Comparison of model-generated and measured water-surface elevations: Kingsville, Ontario, 13-19 Oct 2004.

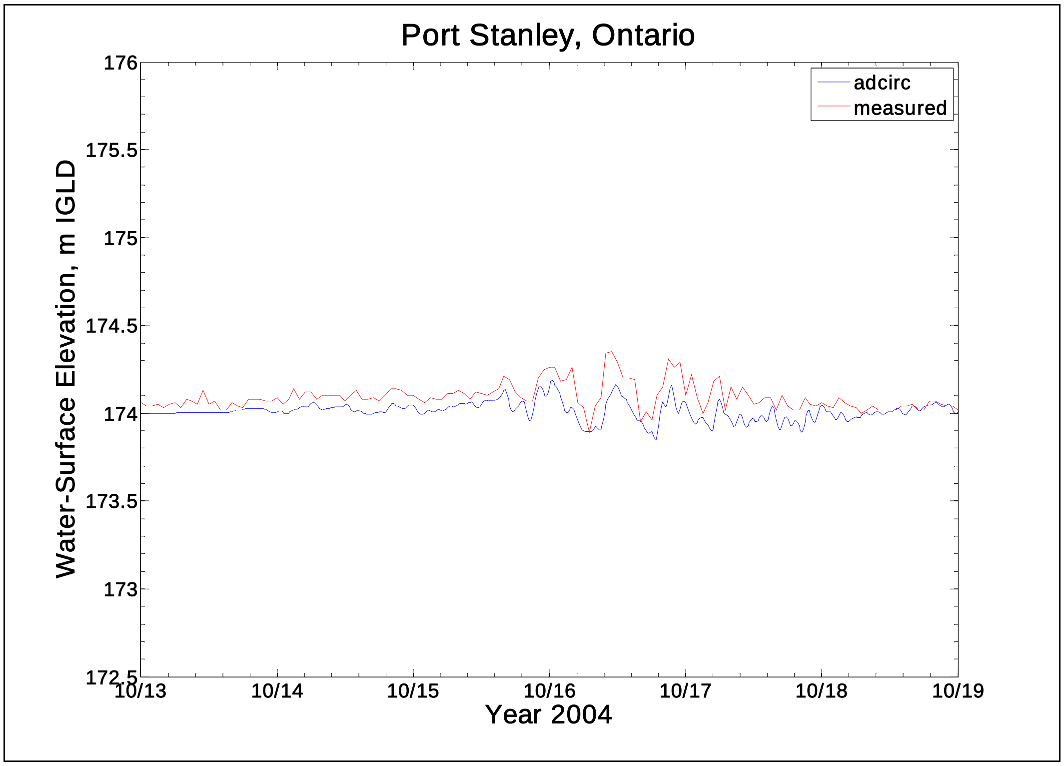


Figure C50. Comparison of model-generated and measured water-surface elevations: Port Stanley, Ontario, 13-19 Oct 2004.

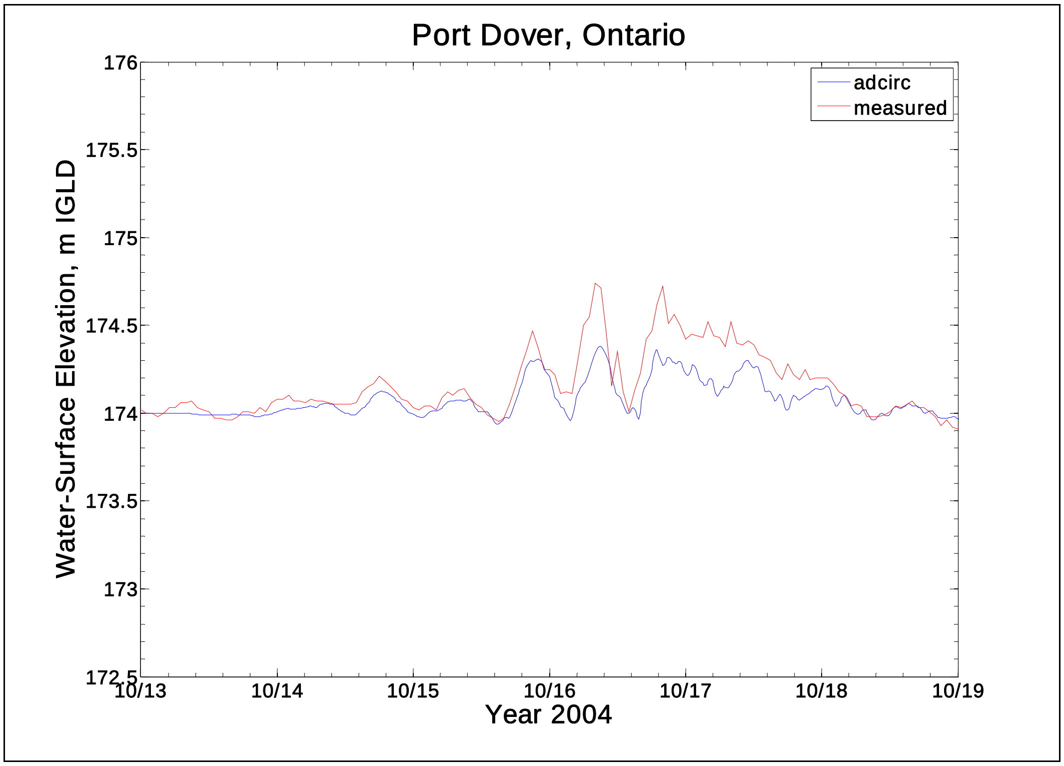


Figure C61. Comparison of model-generated and measured water-surface elevations: Port Dover, Ontario, 13-19 Oct 2004.

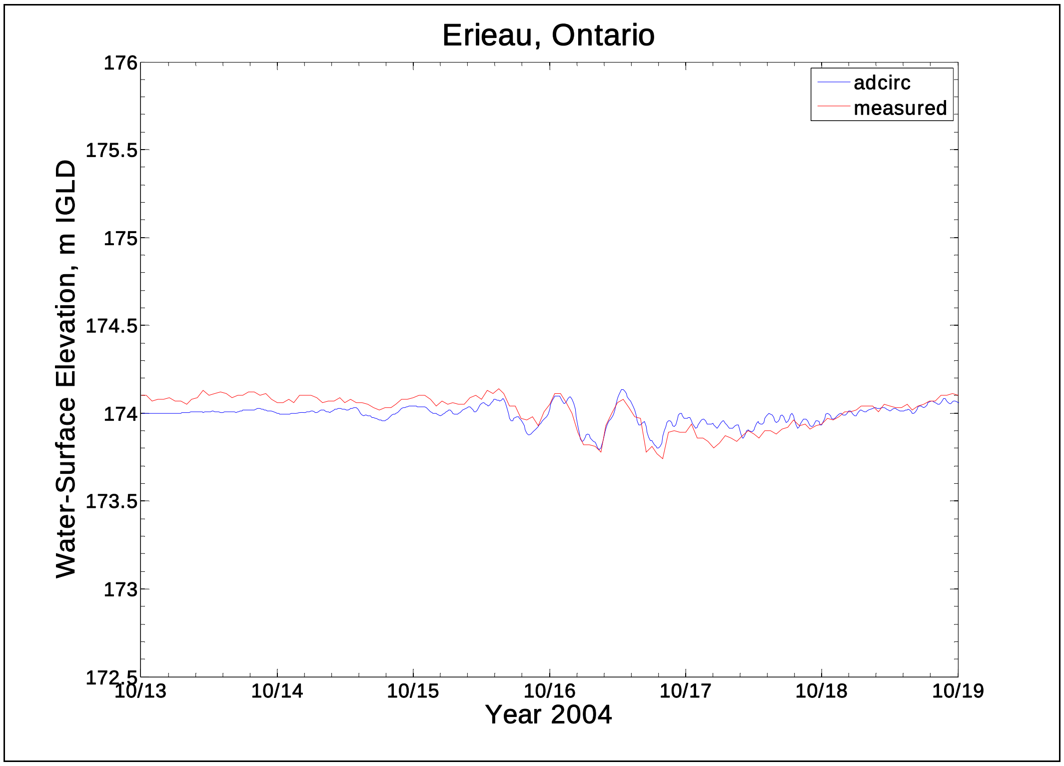


Figure C72. Comparison of model-generated and measured water-surface elevations: Erieau, Ontario, 13-19 Oct 2004.

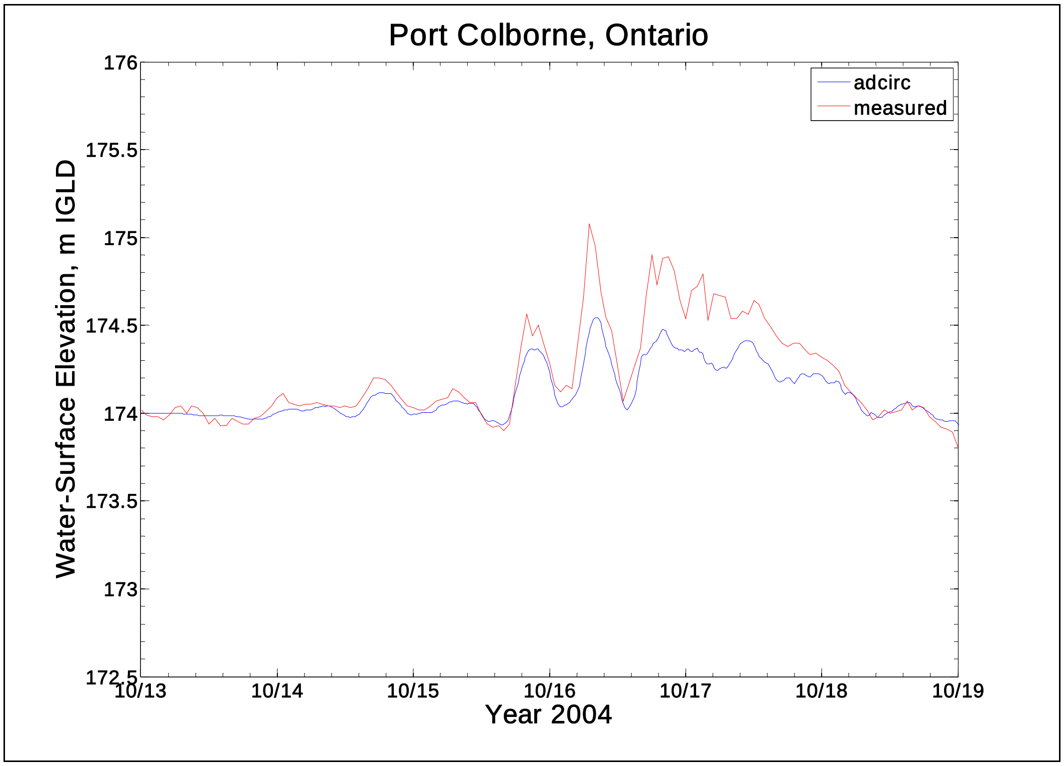


Figure C83. Comparison of model-generated and measured water-surface elevations: Port Colborne, Ontario, 13-19 Oct 2004.

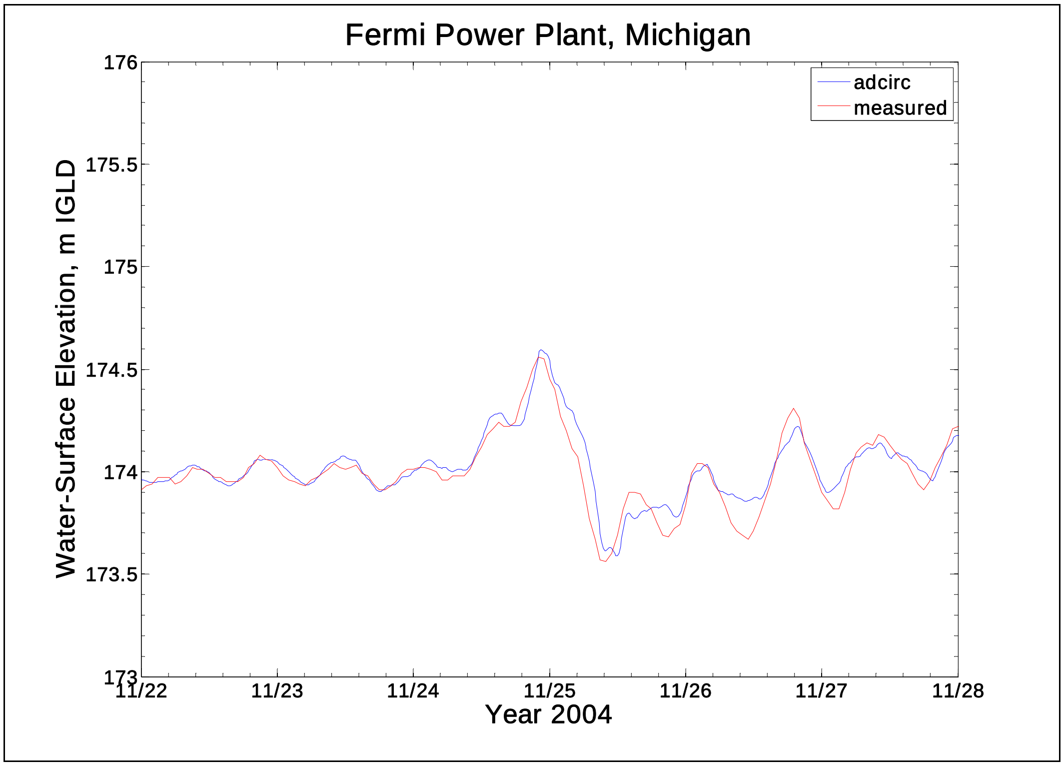


Figure C94. Comparison of model-generated and measured water-surface elevations: Fermi Power Plant, 22-29 Nov 2004.

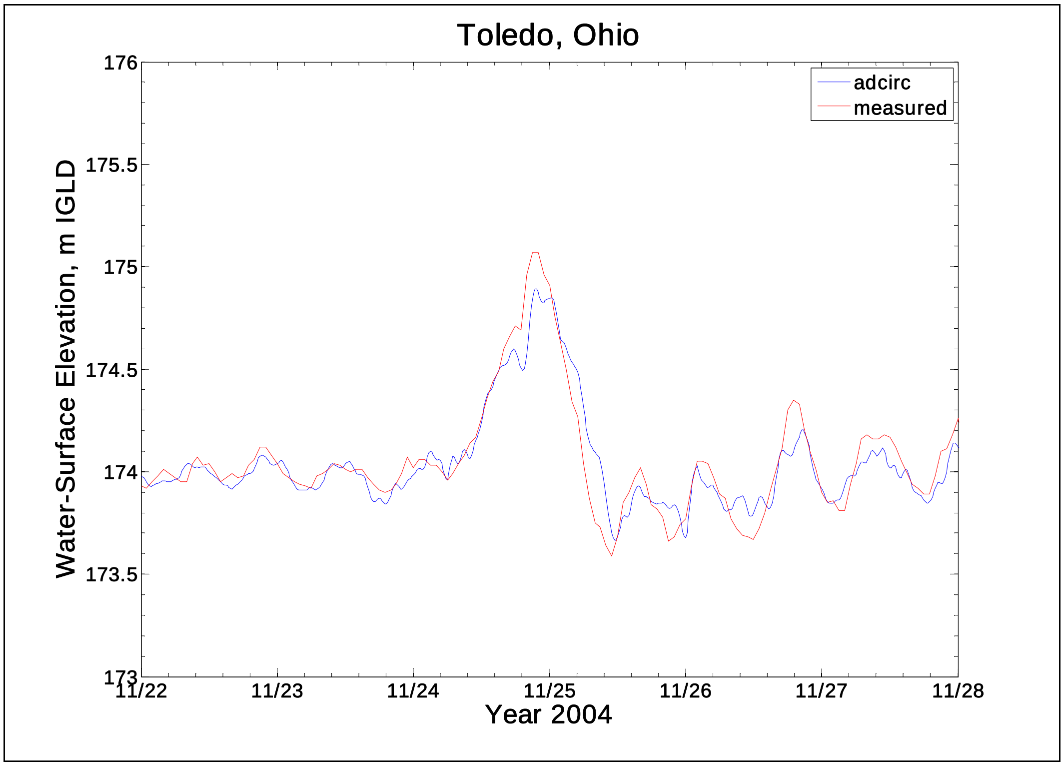


Figure C105. Comparison of model-generated and measured water-surface elevations: Toledo, OH, 22-29 Nov 2004.

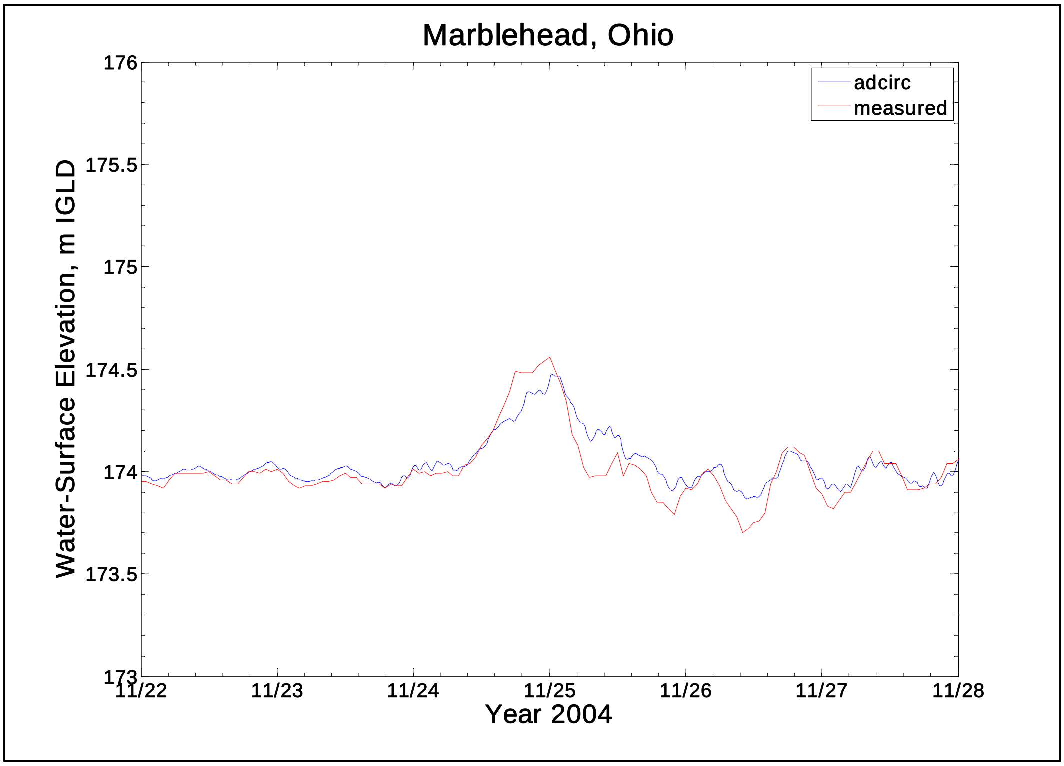


Figure C16. Comparison of model-generated and measured water-surface elevations: Marblehead, OH, 22-29 Nov 2004.

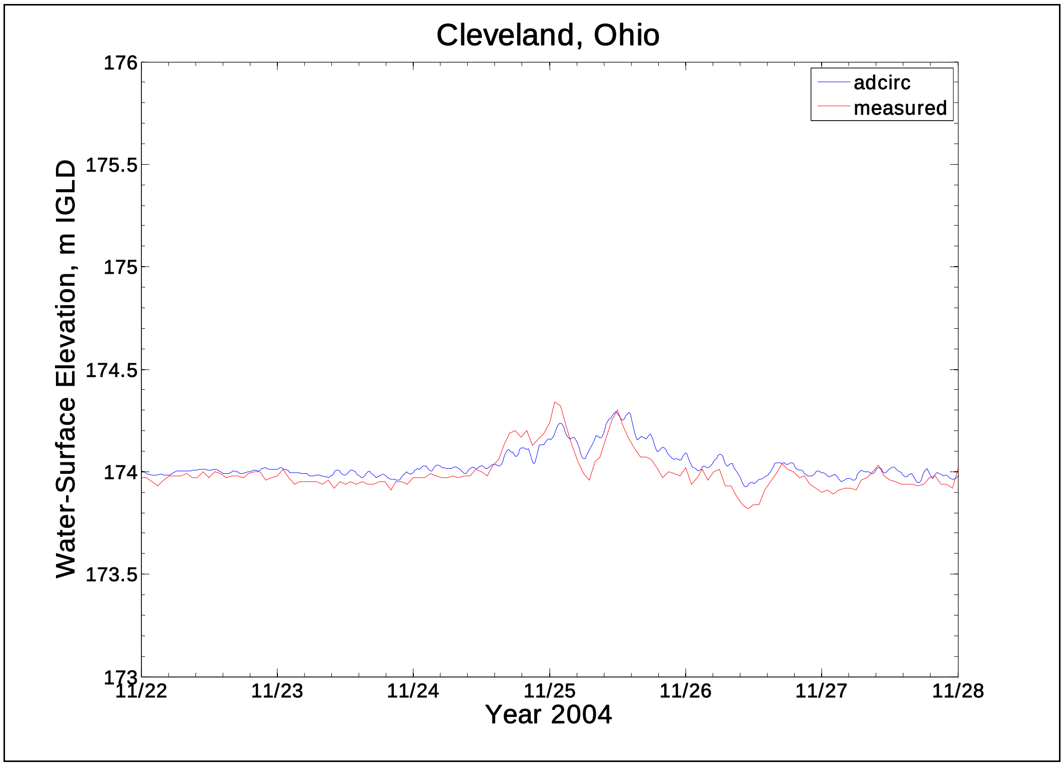


Figure C17. Comparison of model-generated and measured water-surface elevations: Cleveland, OH, 22-29 Nov 2004.

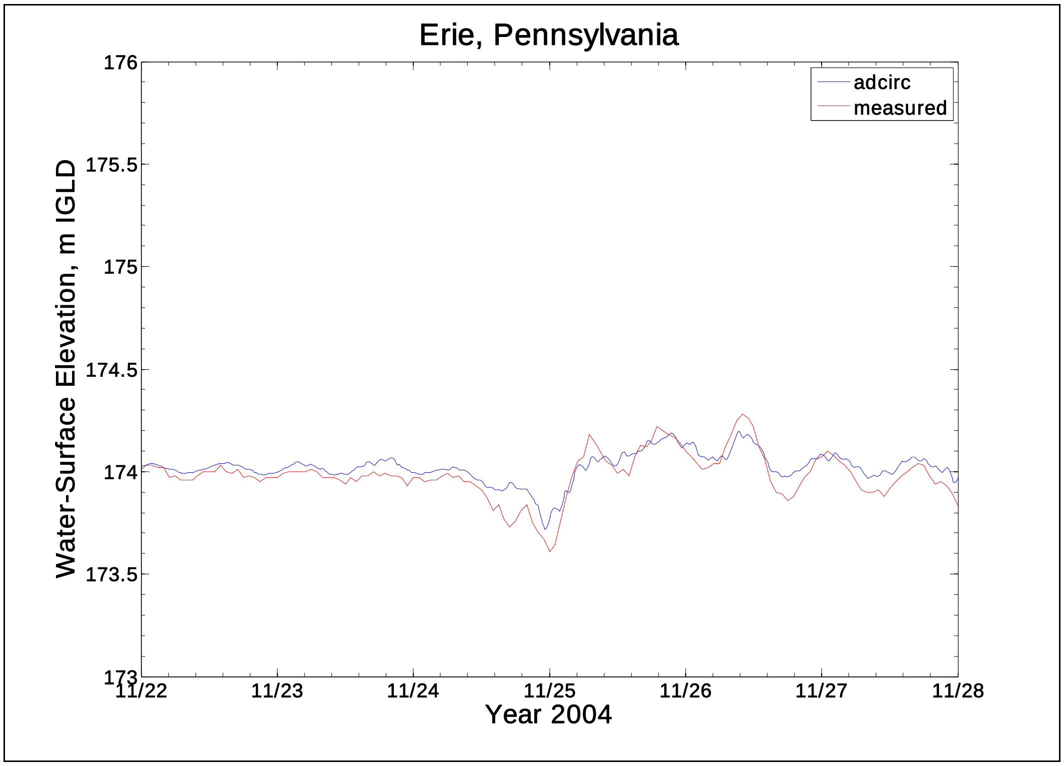


Figure C18. Comparison of model-generated and measured water-surface elevations: Erie, PA, 22-29 Nov 2004.

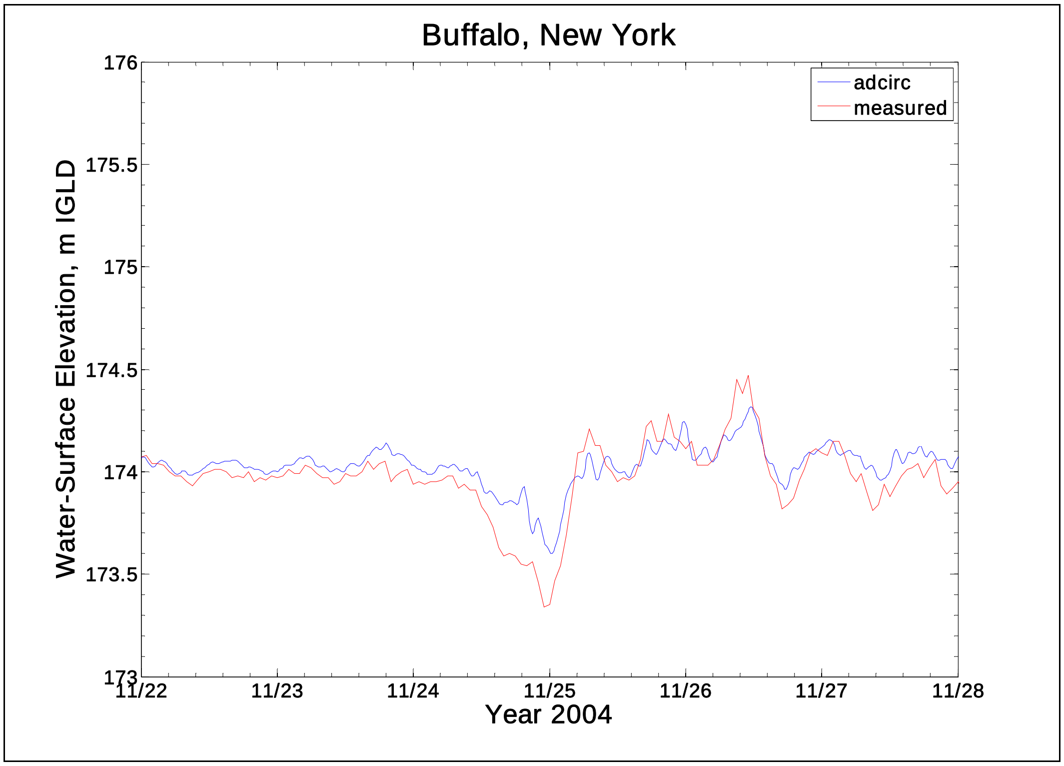


Figure C19. Comparison of model-generated and measured water-surface elevations: Buffalo, NY, 22-29 Nov 2004.

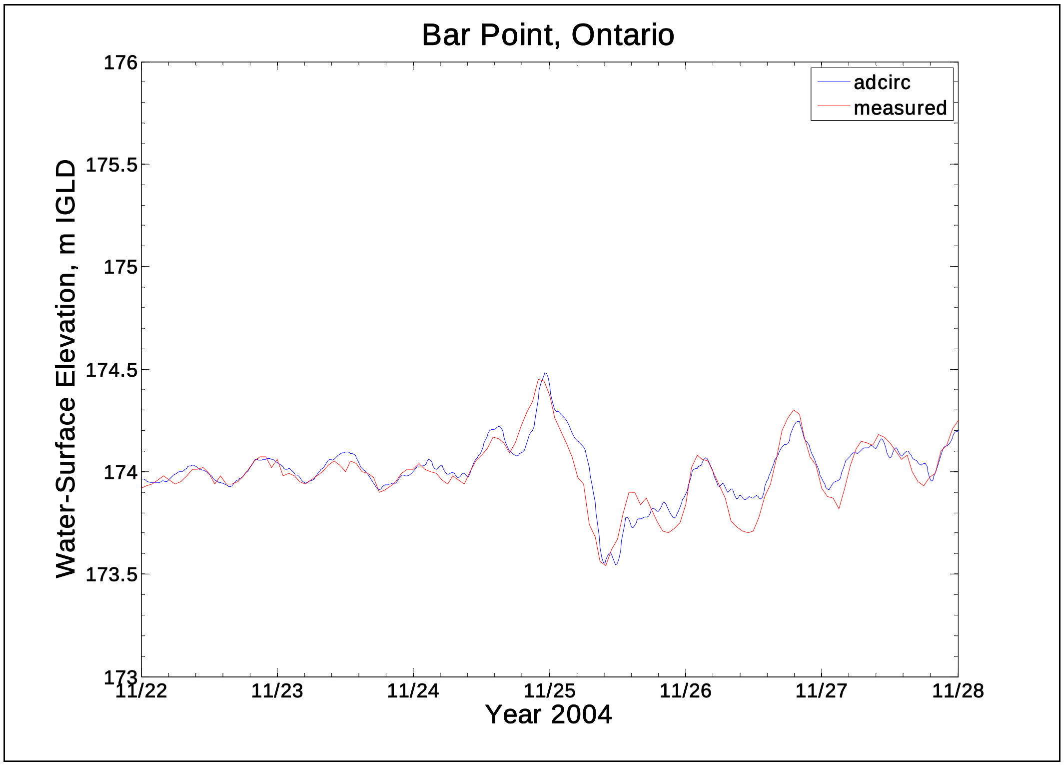


Figure C110. Comparison of model-generated and measured water-surface elevations: Bar Point, Ontario, 22-29 Nov 2004.

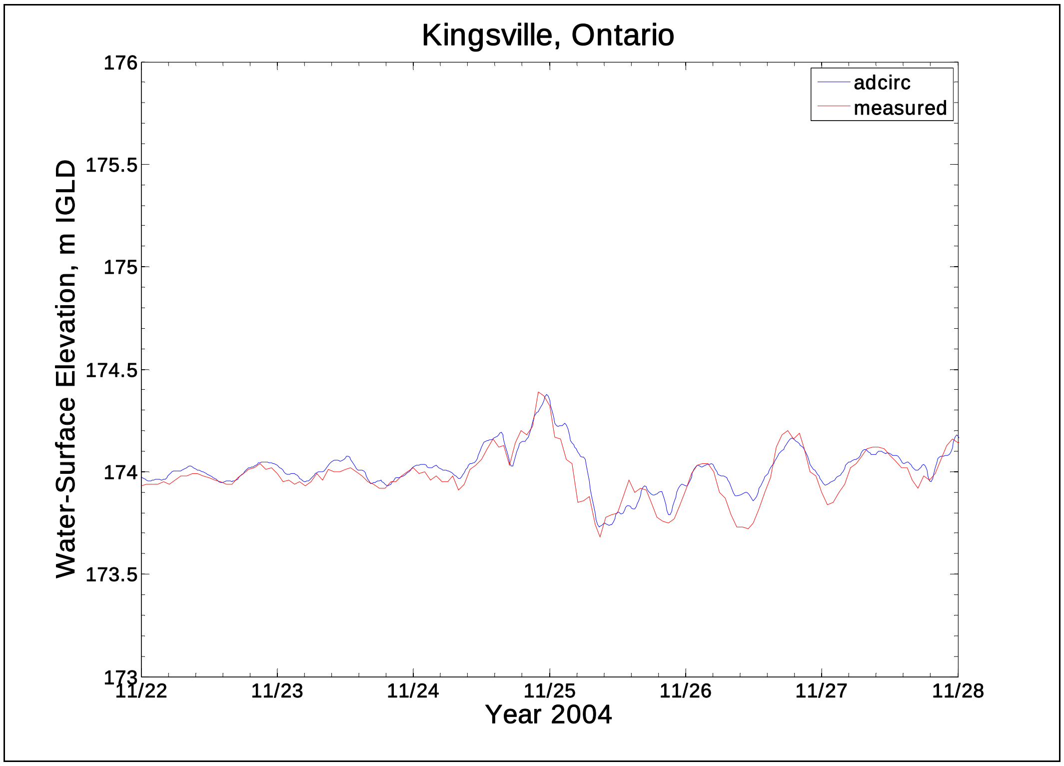


Figure C121. Comparison of model-generated and measured water-surface elevations: Kingsville, Ontario, 22-29 Nov 2004.

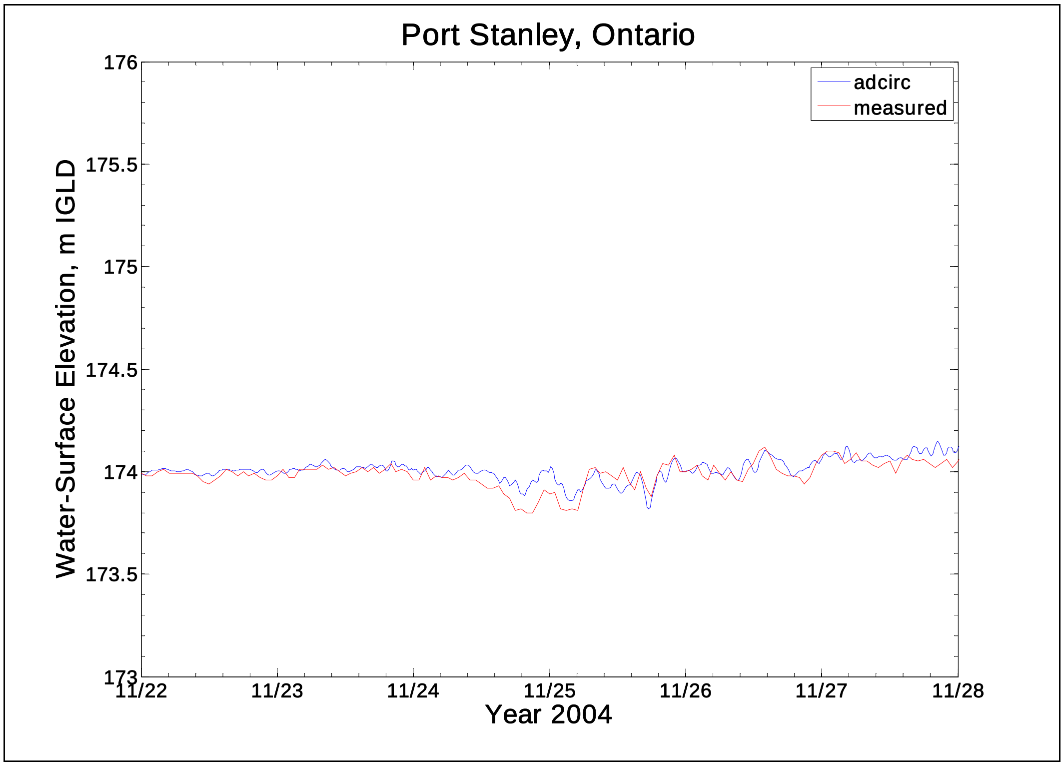


Figure C132. Comparison of model-generated and measured water-surface elevations: Port Stanley, Ontario, 22-29 Nov 2004.

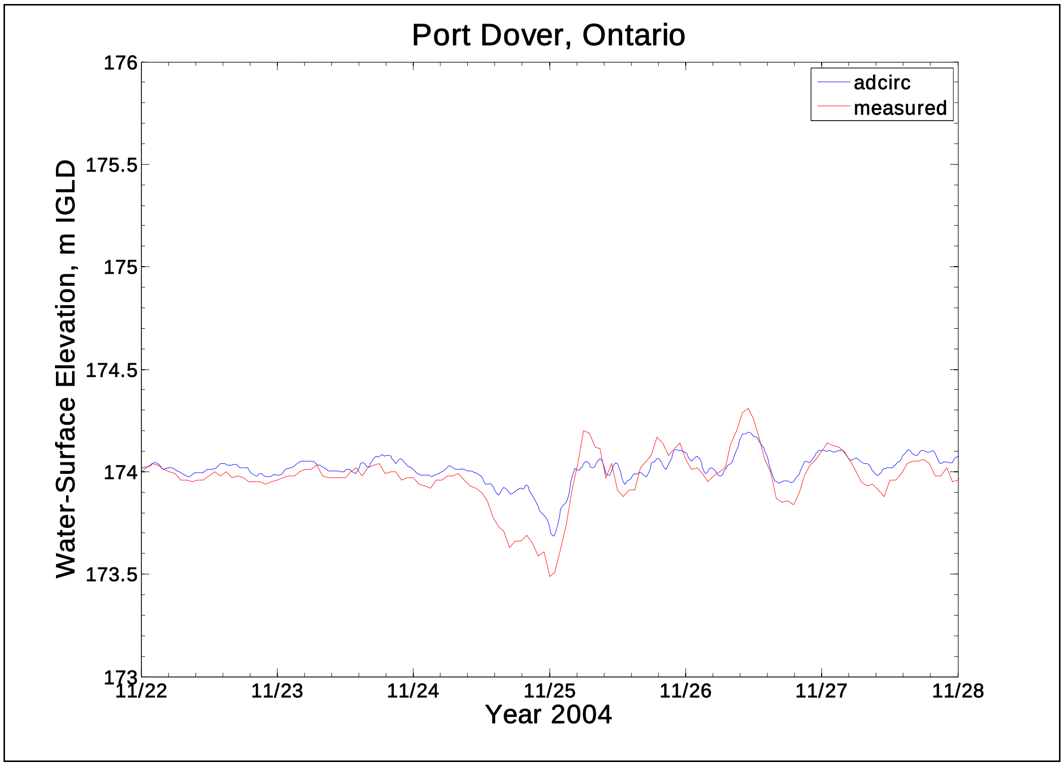


Figure C143. Comparison of model-generated and measured water-surface elevations: Port Dover, Ontario, 22-29 Nov 2004.

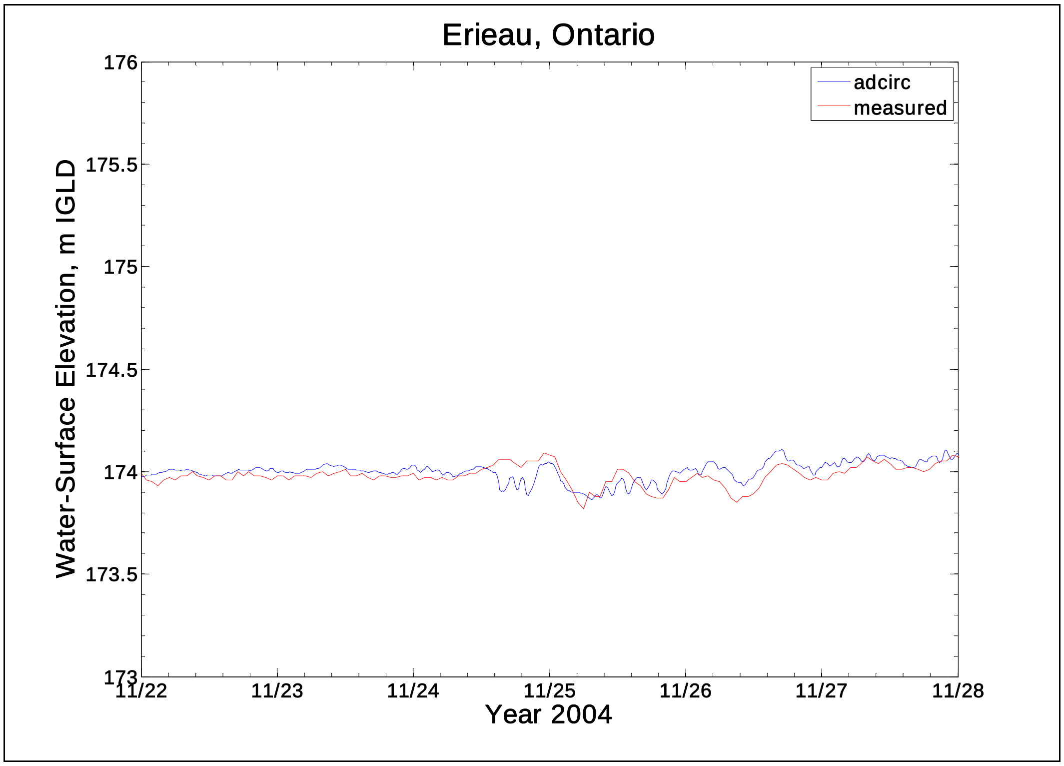


Figure C154. Comparison of model-generated and measured water-surface elevations: Erieau, Ontario, 22-29 Nov 2004.

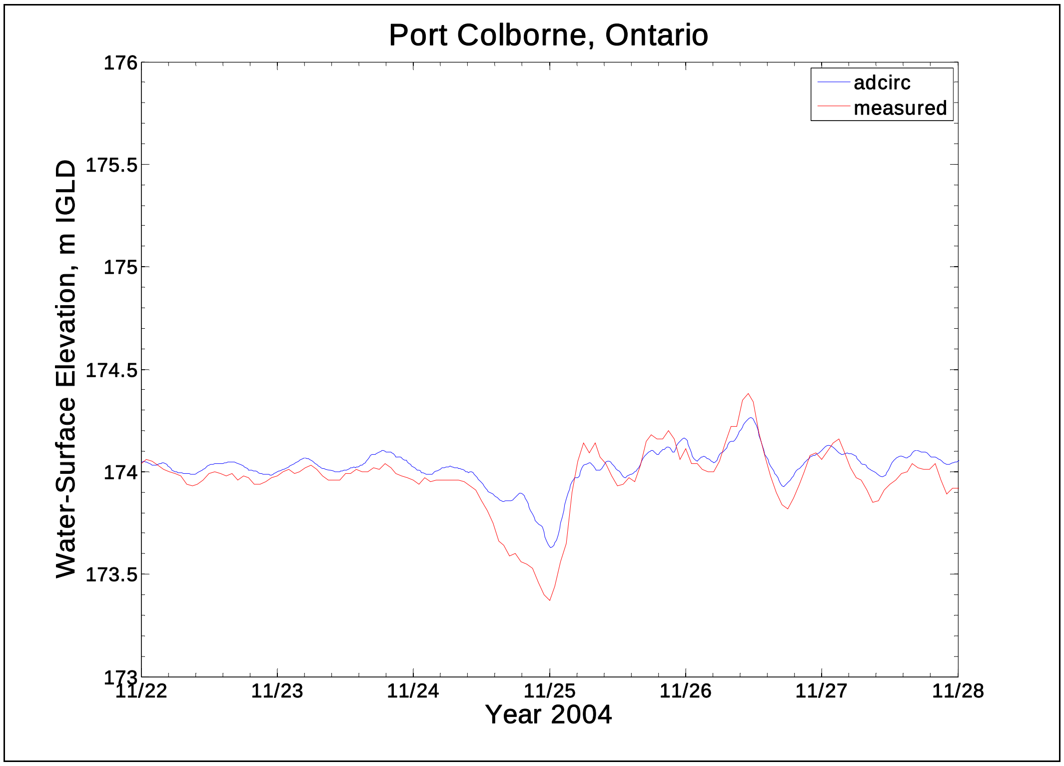


Figure C165. Comparison of model-generated and measured water-surface elevations: Port Colborne, Ontario, 22-29 Nov 2004.

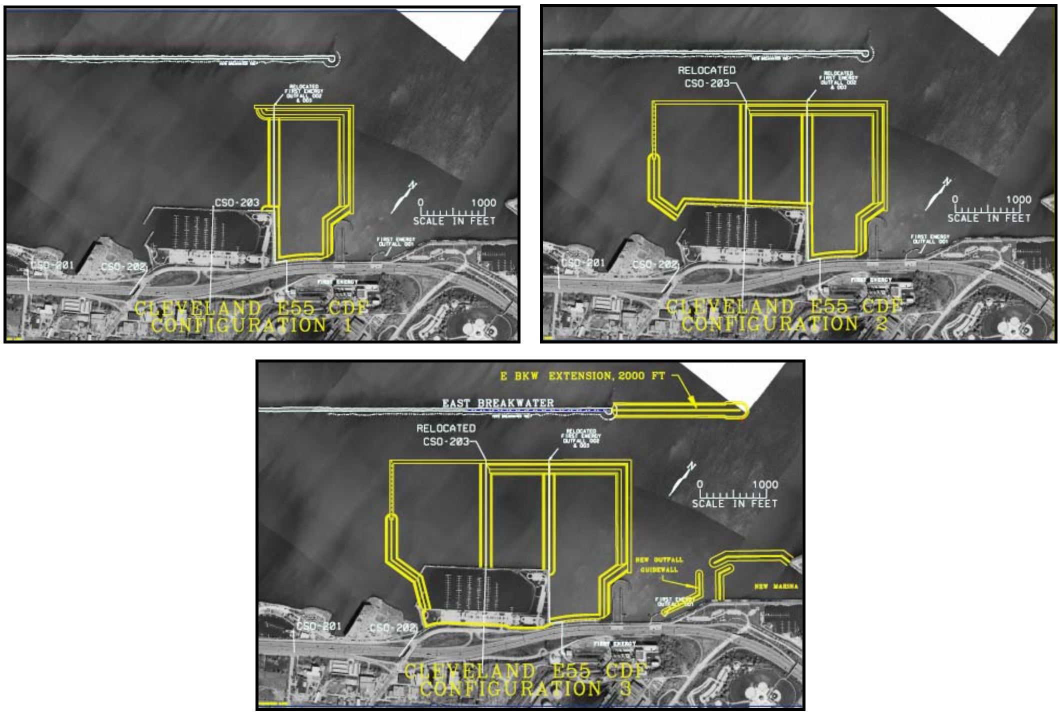
Modeling of Cleveland Harbor CSO Constituent Fate

Introduction and Background

The Buffalo District (LRB) has requested assistance from the Engineering Research and Development Center of the Army Corp of Engineers with developing models to predict the fate of Combined Sewer Outflow (CSO) constituents entering Cleveland Harbor. LRB is currently undergoing plans for building a Confined Disposal Facility (CDF) in this area. One potential site is located at the eastern entrance to the Harbor. However, this site is located in close proximity to the cooling water intake and outfall structures servicing the First Energy Power Plant. This study focuses on comparisons between CSO constituent transport during different design phases of the CDF construction for portions of the harbor, Cuyahoga River, and Lake Erie that may be influenced by CSO material. The modeled phases consist of the existing Harbor configuration as well as three stages of construction (figure 1). Included in this analysis will be three types of sources: 1) neutrally buoyant particles which will represent chemical constituent transport, 2) floatable particles which are representative of debris, and 3) sediment particles. Each particle type is designed to accurately characterize the constituents released from the CSOs utilizing data supplied by LRB. The results of this work will assist LRB with assessing changes to CSO material fate due to these harbor modifications.

To address the issue of the CSO constituent fate, the Particle Tracking Model (PTM) is utilized. One major motivation to use the model is that PTM has been designed to focus on sources expressly indicated by the user. In situations for which the sources of contamination or sediment resuspension are known, PTM works optimally and can simulate multiple scenarios faster than Eulerian constituent transport models. This report presents a concise description of the particle tracking model, an accounting of model input information utilized in the project, and results and analysis of the simulations.

Existing Harbor configuration



CDF construction configurations

Figure 1. Harbor configurations

PTM Model

PTM is an ERDC-developed model designed specifically to track the fate of point-source constituents (sediment, chemicals, debris, etc) released from local sources (outfalls, dredges, etc) in complex hydrodynamic and wave environments. Each local source is defined independently and may have multiple constituents. Therefore, model results include the fate of each constituent from each local source. PTM simulates transport using pre-calculated periodically saved hydrodynamic (and wave) model output. The hydrodynamic model is not coupled to the sediment transport model and therefore can be run once for multiple PTM simulations. Each particle in PTM represents a specific mass (or number of particulates) of one constituent. Total mass is conserved because particles are conserved. Hydrodynamic output does not need to be conservative, so the user can specify hydrodynamic model output for PTM without concern for conservation of water mass. A random walk method is used, in part, to represent particle diffusion. PTM simulations can be either 3D or 2D. For this application, 3D mode is used.

In addition to the hydrodynamic input (i.e. water surface elevation and velocities) that is used as a forcing for particle dynamics, PTM requires mesh and bathymetry information, and sediment characterization of the native or bed sediment (Figure 2). Although PTM does not model native sediment bed transport, it does model interactions between native bed sediments and deposited particles (hiding, burial, etc); therefore bed sediment characteristics must be described by the user. PTM also needs detailed constituent or source information. The user specifies particle characteristics and processes, including settling, critical stresses, and erosion rates. If processes data is not available, these values may be calculated within the model based on verified theoretical relationships. The specific equations for those processes are discussed in detail by McDonald et al (2006). Particles can be positively, neutrally, or negatively buoyant. Positively buoyant, for example, would represent floating debris while neutrally buoyant may represent chemicals and negatively buoyant may represent sediment.

Model output includes a time dependent parcel positions throughout the domain. Various other attributes such as mass, density, and suspension status are also assigned to each of the output parcels. Elevation in the water column is calculated and stored. PTM setup and execution are done within the ERDC-sponsored Surface Water modeling System (SMS) interface. SMS includes multiple tools for post-processing PTM output to assess distribution of concentration, deposition, and other results at any time during the simulation. These results are processed for each constituent from each source or for combined constituents or sources.

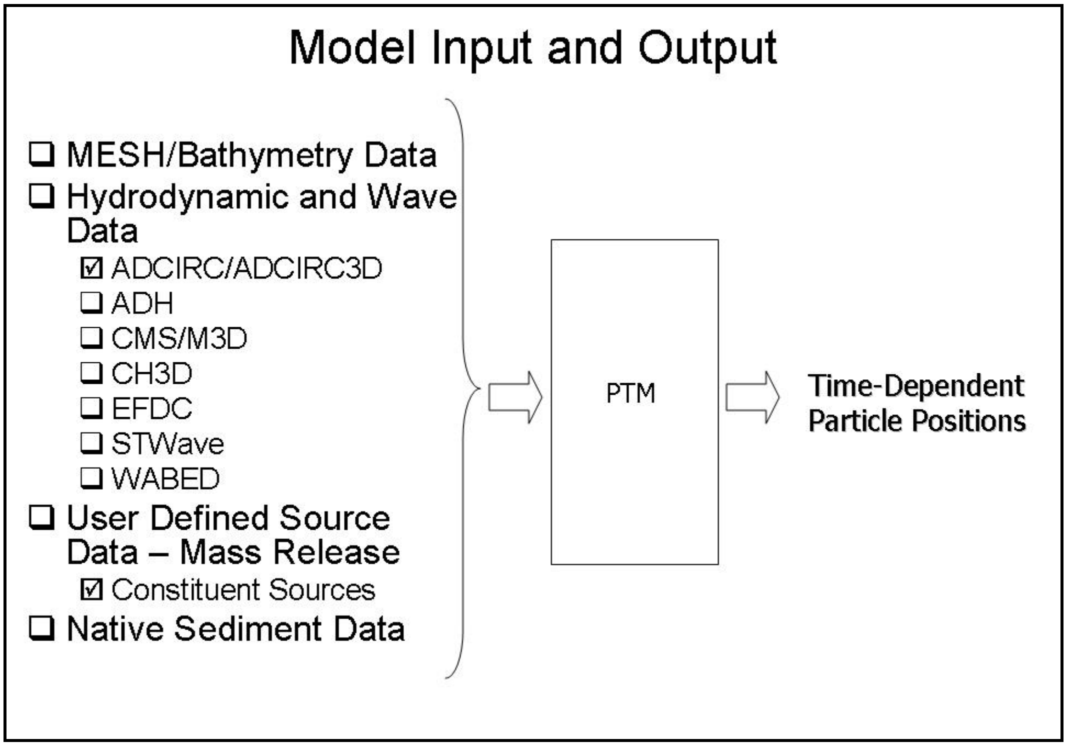


Figure 2

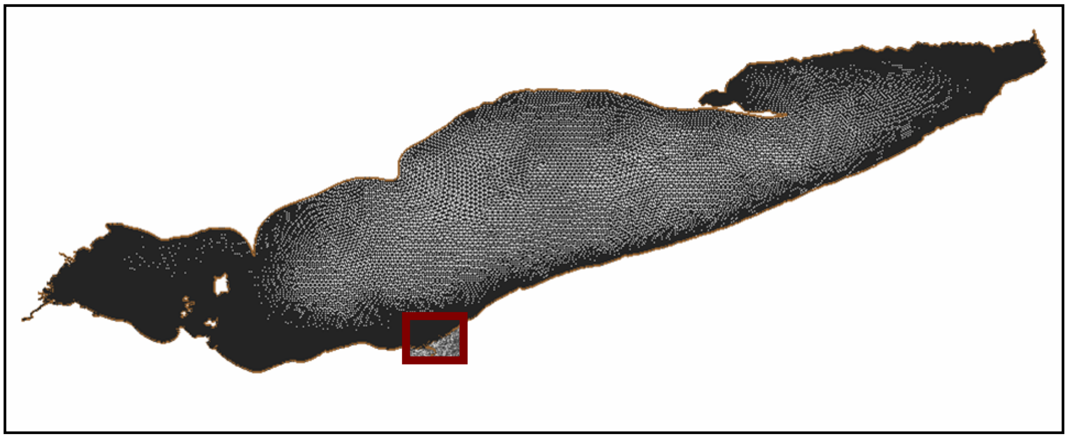
PTM Model Input

Hydrodynamic Modeling

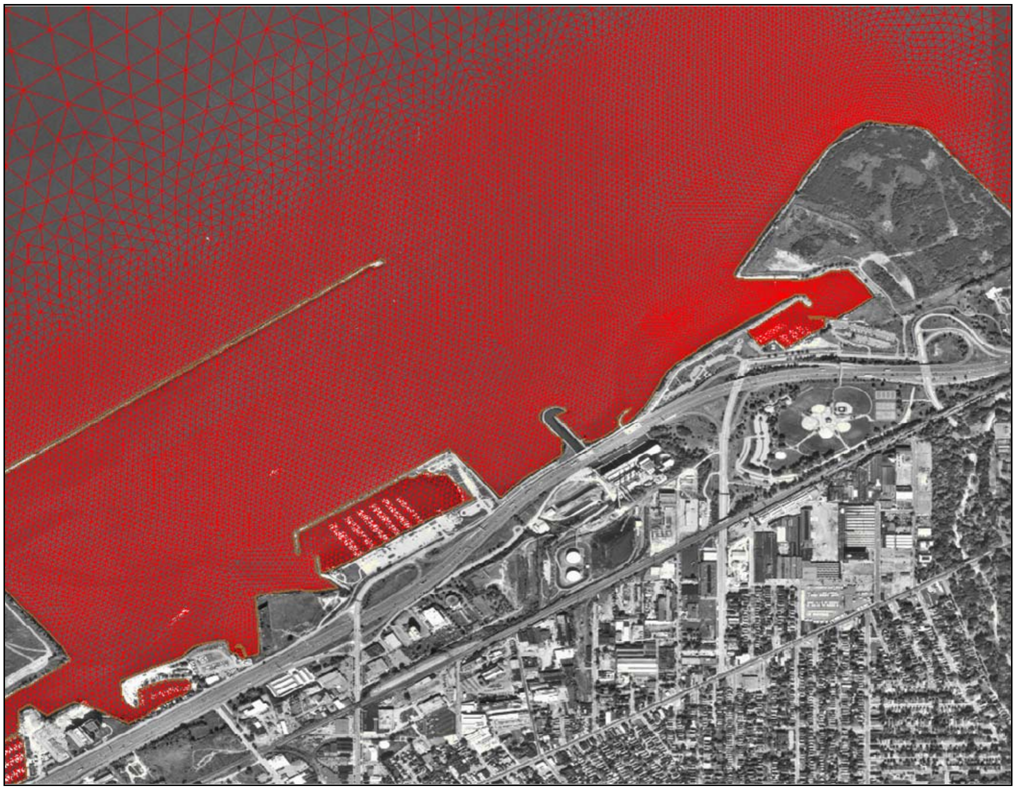
The following sections summarize the PTM input for bathymetry and hydrodynamic forcing. The circulation modeling conducted for Lake Erie, including Cleveland Harbor, was performed using the ADCIRC long-wave hydrodynamic model. The ADCIRC numerical model, a large-domain, two-dimensional (2-D) depth-integrated finite-element hydrodynamic circulation model, was applied in this study to provide water level and depth-averaged current (circulation) information for Cleveland Harbor, Ohio (Mark et al 2008). This component aims to characterize water levels and currents throughout the Harbor presently in existence and to predict any potential impacts that may result from constructing a Confined Disposal Facility (CDF).

Bathymetry and Mesh

Figure 3a displays the grid developed for this study. As shown, the model domain encompasses the entire Lake, and includes the lower reaches of the Cuyahoga, Maumee, Detroit, and Niagara Rivers. Figure 3b shows the grid in the vicinity of Cleveland Harbor projected onto a map of the area.



a) Lake Erie ADCIRC grid



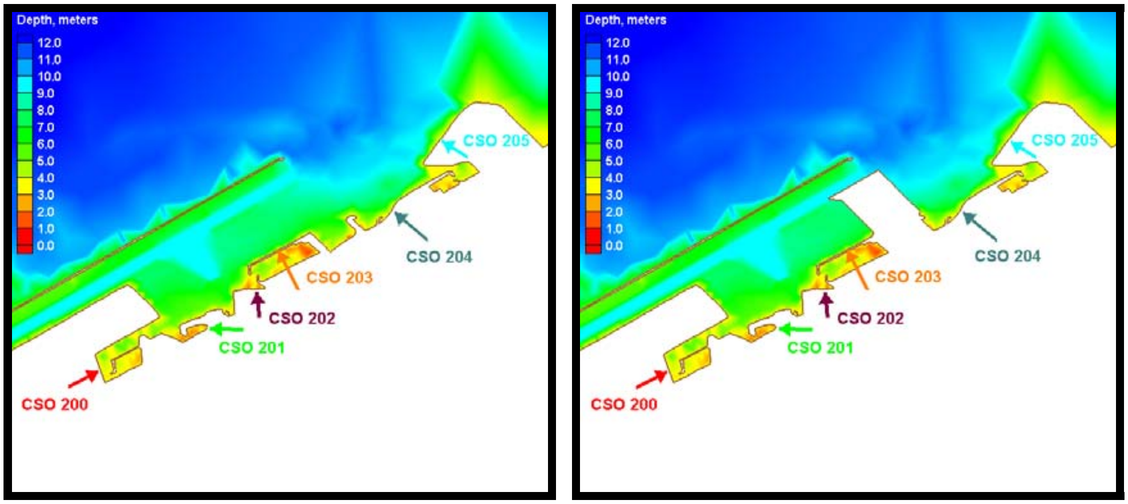
b) Lake Erie ADCIRC grid in project area.

Figure 3

The grid highly resolves the entire Harbor and its main, western, and eastern entrances, together with the lower reaches of the Cuyahoga River. This existing-configuration or base grid consists of 95,255 nodes and 183,034 elements, of which 30,628 nodes and 62,038 elements resolve the Harbor. The largest elements reside in the central Lake basin, having nodal spacing of about 24 km, whereas the smallest elements resolve the western Harbor entrance, where their widths are approximately 15 m. For most of the Harbor, including the area of the proposed CDF, nodal spacings are approximately 20 m. Included in the grid are the power plant's outfall and intake structures.

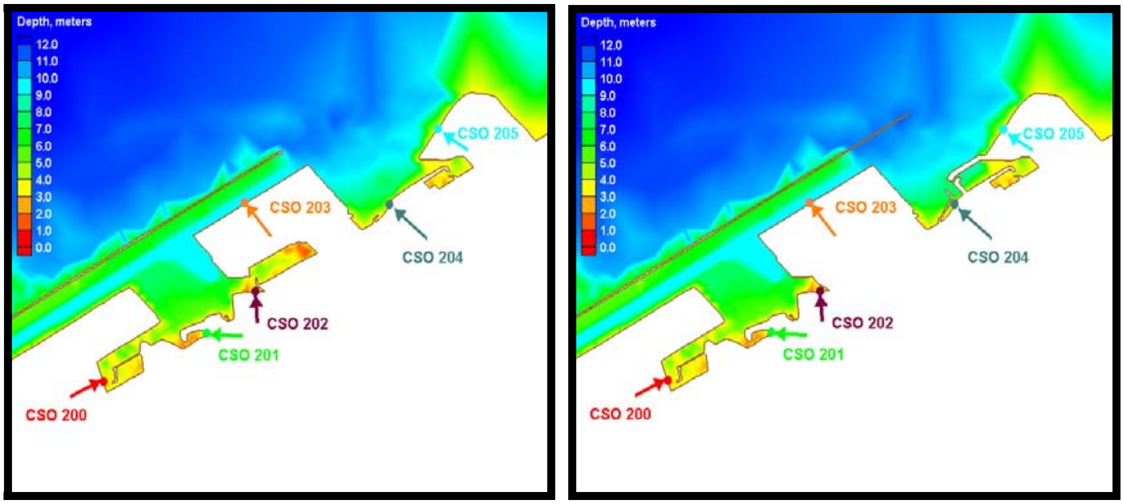
The grid boundary along the Canadian shoreline was aligned with the shoreline shown on satellite imagery published by NaturalVue, which are digitally enhanced images taken by the Landsat satellite. These imagery have a 15-m resolution. For areas within the United States, shoreline positions are based on satellite imagery published by the U.S. National Geo-spatial Intelligence Agency (formerly the Defense Mapping Agency), and have a resolution of 5 meters. In the vicinity of Cleveland Harbor, U.S. Geological Survey Digital Orthographic Quarter-Quadrilateral (DOQQ) imagery was used in aligning the grid shoreline and its coastal structures. The DOQQs have a resolution of about 1 m.

Bathymetry specified in the grid was obtained from two sources. For Cleveland Harbor, bathymetry was extracted from contours and soundings residing in the U.S. National Oceanic and Atmospheric-published Electronic Nautical Chart. For the remaining regions outside of the Harbor, bathymetry data was extracted from the National Geophysical Data Center (NGDC) Coastal Relief Model database for Lake Erie as well as Lake St Clair. For both data sources depths are referenced to the International Great Lakes Datum 1985 (IGLD). Figure 4 shows the base and plan configurations with bathymetry contours. The arrows indicate the location of the CSO outfall locations. As seen in the figures, the depth varies between the CSO release points (approximately 3 meter depth) and the East breakwater (> 10 meters). Also noted is the change in the position of CSO 203 between the existing condition and the addition of the CDF.



Base Grid (Existing Conditions)

Alternative 1Configuration



Alternative 2 Configuration

Alternative 3 Configuration

Figure 4

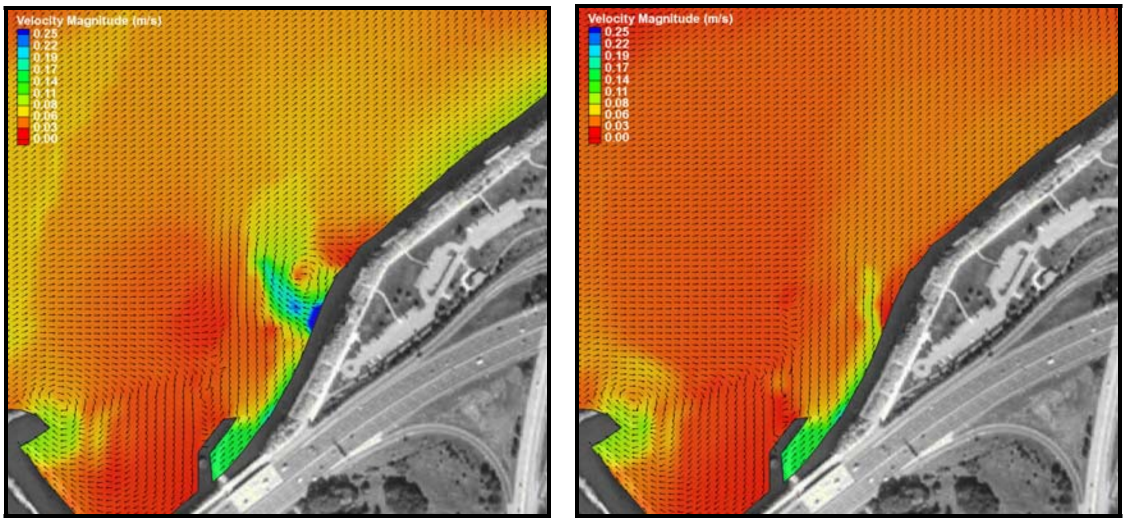
Boundary Conditions and Forcing

Wind data were obtained from the National Oceanic and Atmospheric Administration's (NOAA) Great Lakes Environmental Research Laboratory (GLERL), and were generated as part of their Great Lakes Coastal Forecasting System (GLCFS). One component of the GLCFS is the generation of wind fields subsequently used in circulation and water level now-cast simulations. Hourly wind speeds and directions were extracted from GLCFS archives. These data are provided at 5-km intervals that encompass the entire Lake.

Water level data for model calibration and validation consist of 12 gauges and were obtained from the U.S. National Ocean Service (NOS) and the Environment Canada-Canadian Marine Environment Data Service (CMEDS). River inflow data measured in the Detroit River were obtained from the U.S. Army District, Detroit, whereas flow rate data specified for the Cuyahoga, Niagara, and Maumee Rivers were obtained from the USGS stream flow web site.

The CSO inflows were time-varying flows with the hydrographs being provided by the LRB for the 6-month and 5-year design storms (Appendix A). Further details concerning the CSO input can be found in the Hydrodynamics and PTM Source Development sections.

Figure 5 shows velocity contours and vectors at CSO 204 for the 5-year design storm. The first picture depicts a time (8/14/2002 23:30) during outflow into the harbor and the second shows a period where there is no outflow (8/15/2002 02:00). Because the outflow effect on the surrounding flow was unknown, it was important to add the discharge into the harbor as a boundary condition for the hydrodynamic model as well as modeling the outflow particle sources to determine the overall fate of constituents.

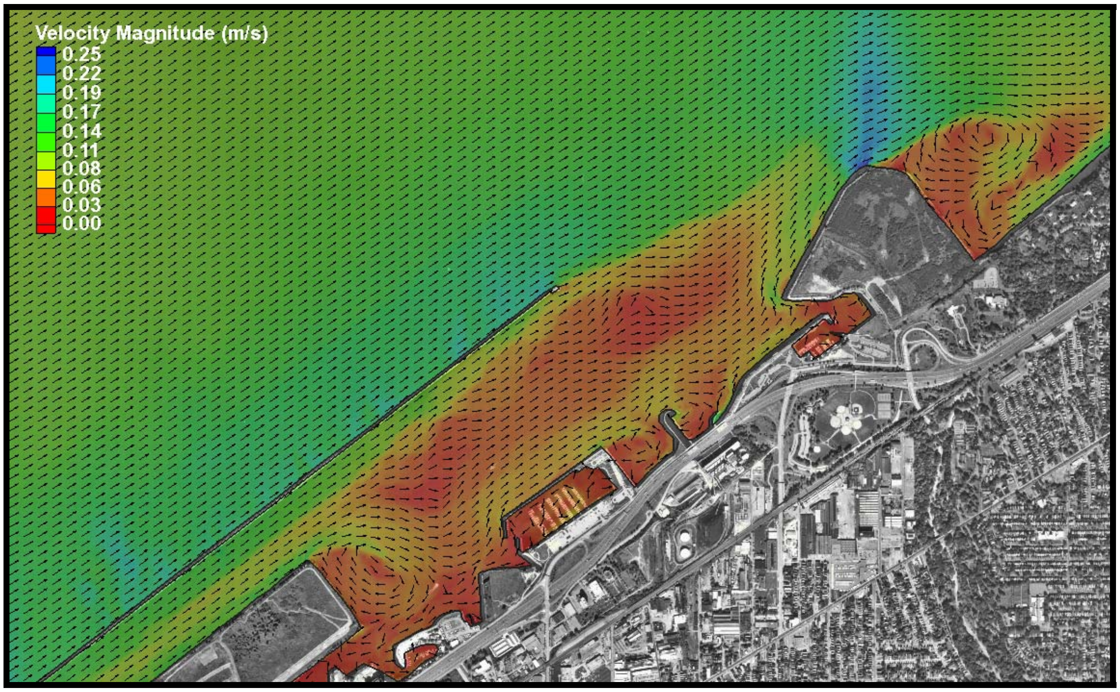


CSO 204 – During outflow into Harbor CSO 204 – After outflow into Harbor

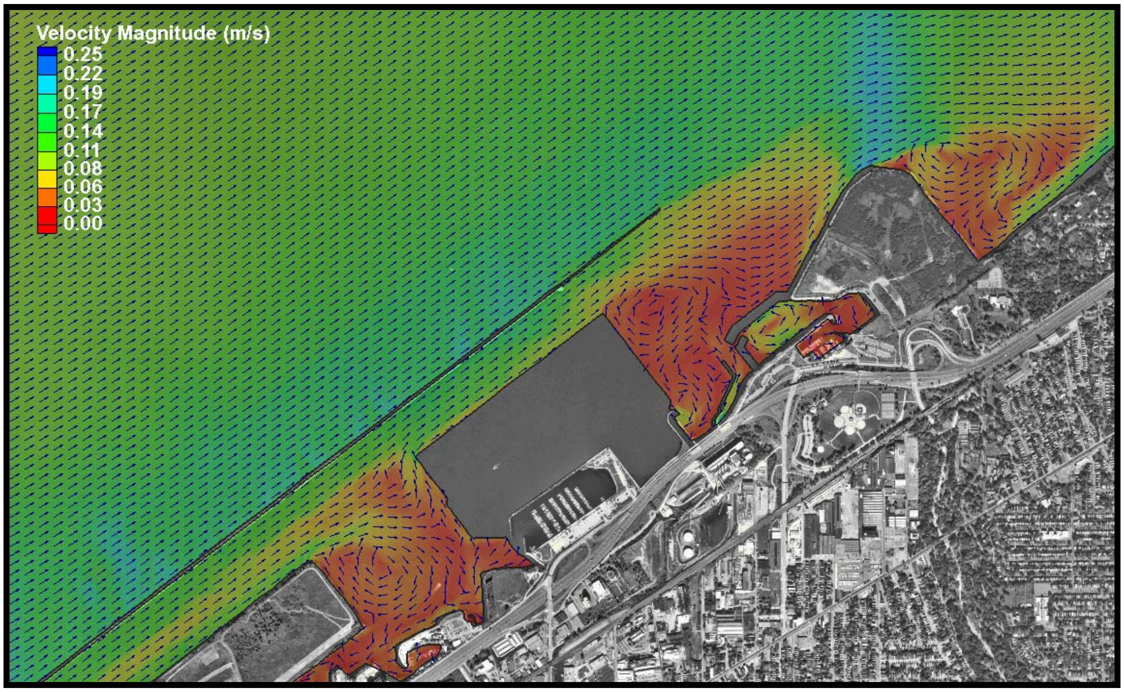
Figure 5. Velocity contours and vectors at CSO 204 for the 5 year design storm

Hydrodynamics

ADCIRC was run from July 30 at 0:00, 2002 to September 24 at 24:00 with the solution being saved every half hour. Hydrodynamic conditions were run for two specific design storms: 6-month and 5-year. Initially, the intent was to obtain actual discharges during the simulation period (summer 2002). However, due to the unavailability of the data, it was determined that instead two design storms would be utilized to represent normal and extreme conditions. The



Existing Conditions – 8-16-2002 (00:00)



Configure 3 – 8-16-2002 (00:00)

Figure 6 contours of velocity magnitude and vector

actual precipitation recorded at the Cleveland airport during the simulation period was plotted and used as a basis for the CSO inflow by inserting the 6-month and the 5-year flows during the times of significant recorded precipitation. Within the data it was determined that a significant rainfall event occurred on August 14. The timing of the maximum rainfall occurring in the design storms were matched to the maximum measured rainfall during this period. Therefore, the design storms were run during a measured rainfall event to best replicate the behavior of true storm conditions. The PTM simulation, which will be described in another section, starts at 19:00 August 14, 2002 which is directly following the significant storm event and therefore when the CSOs discharge into the harbor and particles exist to be tracked.

Seen in figure 6 are hydrodynamic results (contours of velocity magnitude and vector) at 00:00 August 16, 2002. This is a point at which the storm event has past and all particles have been released into the harbor for transport. It does not appear as if the CDF structure has changed the magnitude of the flow in the area. However it is immediately noticeable that the recirculation patterns on both the westward and eastward side of the CDF are different. This change has the potential to greatly affect the transport of the particles. For neutrally buoyant particles, this means that particles may passively mix in different patterns. That is, the mixing rate may be the same but the coherent structures that are visible during mixing may be altered. For sediment particles, tight areas of recirculation may impede immediate transport which might allow particles a greater opportunity to deposit.

PTM Source Development - CSO flows

In this study, six CSO locations were identified (Figure 4). To simulate these sources, PTM requires the following user specified data:

- Date/Time of CSO release
- Positions (x,y,z) of CSO introduced into the water column
- Rate of constituent introduction
- Size distribution of suspended constituent
- constituent density

The date and time release were determined based on the design storm conditions (figure 7). PTM sources were introduced at each CSO at the top of the water column. CSO flows for two design storm conditions—6 month and 5 year storms—were used in this study (figure 7). As mentioned in the hydrodynamic section, due to the unavailability of actual discharges during the simulation period, in order to capture the result from larger discharge events, hypothetical CSO discharges were developed. The City of Cleveland computed 1-, 4- and 6-month and 1-, 2-, and 5-year rainfall amounts and discharge hydrographs at the six CSOs. Only the 6-month and 5-year discharge hydrographs were used, with the 5-year hydrograph computed by increasing the 6-month hydrograph by the ratio of the 5-year and 6-month rainfall amounts. Generally it can be seen that rainfall and discharges for the 5 year storm were approximately double of those for the 6 month storm. Each storm-induced CSO event lasts about 7 hours lagging the precipitation.

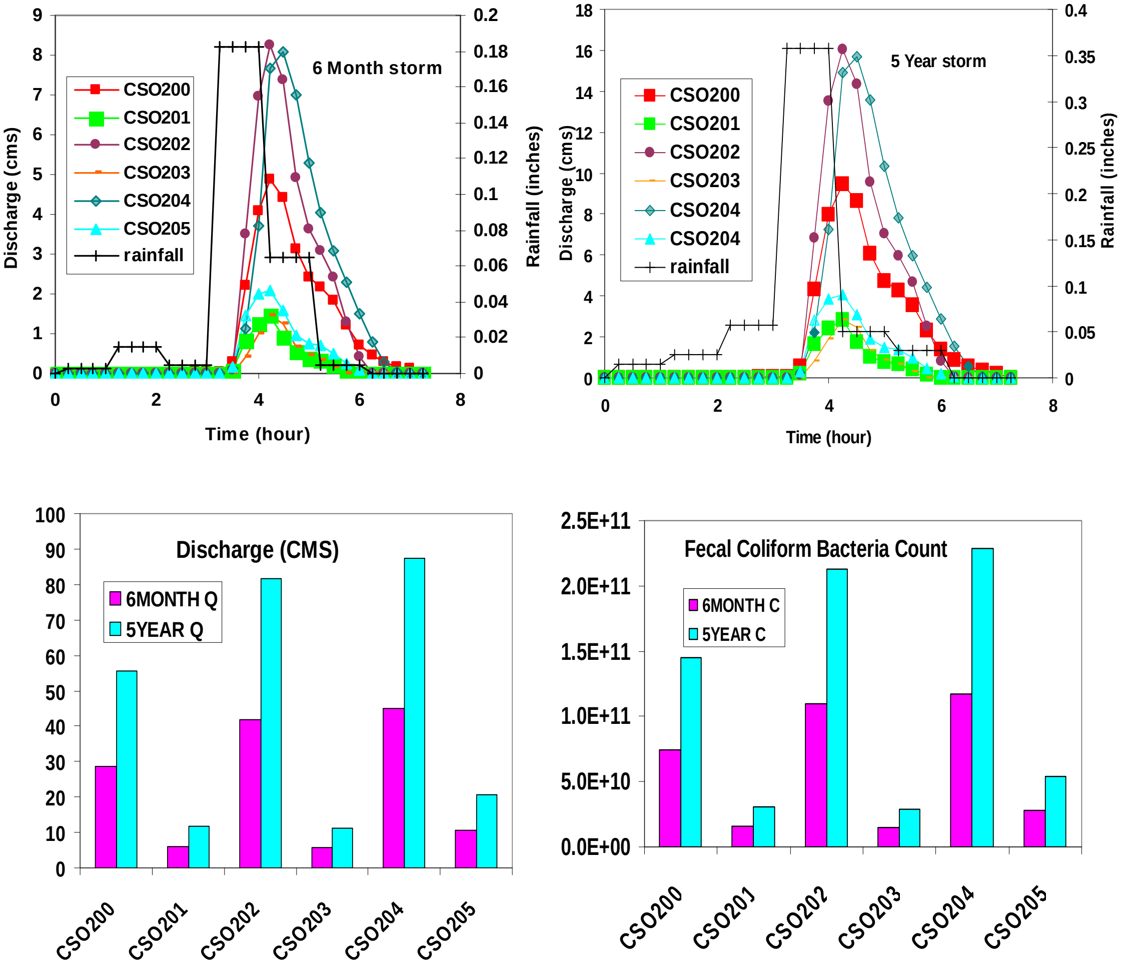


Figure 7. Storm conditions. Upper panels show CSO discharges from 6 month and 5 year storms. Also shown are the rainfalls. Lower panels show total discharges and FCB counts during events.

There are strong correlations between CSO flows and fecal coliform bacteria (FCB) counts. The time 00:00 of events were set at 19:00 of August 14, 2002 which coincides with wind events. The raw data for CSO flows and FCB counts are given in Appendix A, while Figure 7 displays a graphical representation of this data. The FCB counts were developed from a constant concentration value of 261,000/100ml, supplied by the City of Cleveland. The rate of introduction for particles into the Harbor was determined based on the CSO discharge and subsequently the FCB count. The ratio of simulation to FCB counts were set as 1: 107 so that total number of particles released were approximately 1200 and 2400 for 6 month and 5 year storms, respectively.

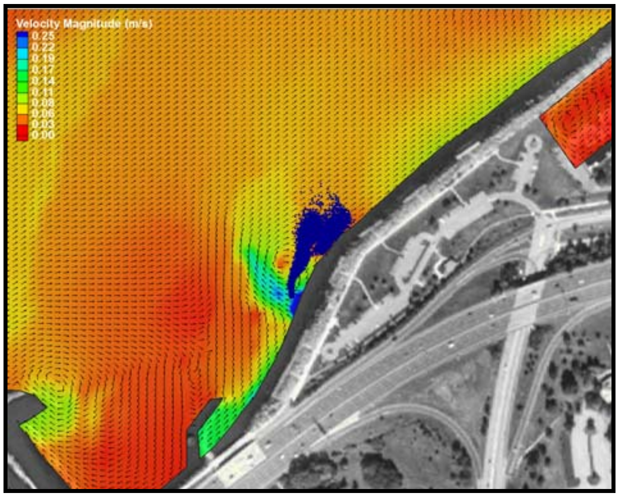


Figure 8 – CSO 204 During outflow into Harbor

Native Sediment

Native sediment grain size distributions did not influence the outcome of particles introduced into the Harbor which were neutrally buoyant or floating. Particle deposition was extremely limited, only occurring due to the vertical fluctuations in the particle position due to the random walk diffusion calculations. However, for sediment particle transport, native sediment characteristics were required to accurately determine particle bed interactions. A fine grain sediment distribution was utilized (D50=100 microns).

PTM Simulation Details and Results

The PTM simulation starts at 19:00 August 14, 2002 and ends 00:00 September 15, 2002. The calculation time step is 30 seconds. Three sets of runs were implemented—(1) neutrally buoyant particles (particle density = water density), (2) floatables (particle density < water density), and (3) sediment particles (particle density > water density). No-decay of particles was assumed for each of these sets.

Chemical Transport (Neutrally Buoyant Particles)

Advection of the particles released from the six CSOs closely followed the circulation patterns (figures 9 through 12). In these figures, particles are colored based on the CSO from which they originate (figure 4) and snapshots are shown of transport one, six, eleven, seventeen, and thirty days after release. The final figure shows a zoomed in view of day thirty after release. For succinctness, only the base case (figures 9 and 10) and configuration 2 (figures 11 and 12) are shown to depict the transport currently in existence and the predicted worst case scenario. However, general trends will also be discussed and appendix B contains results for all configurations. Figures 9 and 11 show results based on the six month design storm. Figures 10 and 12 depict results based on the five year design storm. In figure 9, a common trend is visible that is generally followed throughout figures 10-12. Initially there is very little mixing of particles for all CSOs. However, particles from CSO205 (turquoise dots) were immediately advected Eastward by currents induced by dominant Southwesterly winds. After six days particles are diffused throughout the harbor region and have escaped past the East Breakwater. At this point it is hard to find particles from CSO205 in and near the Harbor for the base and all three alternative design configurations. After seventeen days particles are dispersed throughout the system though it begins to be very noticeable that particles are trapped in CSO200 (red dots) for all designs. For the base configuration some particles also remain trapped near the CSO 203 location. This characteristic is even more evident in configuration 2. It should be mentioned, that due to the completion of the CDF, these particles are no longer trapped in configuration 3. Finally after the thirty day period, most of the particles have been advected away except those previously mentioned, confined particles. Investigation of the hydrodynamics shows that not many particles from CSO200 (red dots) escape from the Harbor because of poor circulations in the adjacent water in the base and all three alternative design conditions.

The particles from CSO202 (purple dots) and CSO204 (teal dots) dispersed rapidly in all configurations. Most particles from CSO201 (green dots) and CSO203 (orange dots) exited from system eventually but this is probably due to the small number of particles associated with low discharges. The hot spot near CSO200 was associated mostly with particles originated from

CSO200 (red dots). Another hot spot, for Configuration 3 is linked to the particles released from CSO204 (teal dots). Particles in this configuration become trapped in that area.

Figures 13 and 14 show the particles on 00:00 of August 16th—approximately 1 day after 6-month and 5-year storm events, respectively for all four configurations. The distribution patterns for the two storm events are similar. However, 5-year storm events are associated with more densely packed particles. The majority of particles from CSO200, CSO201, CSO202, and CSO204 are trapped in the system because of the structural confinements. Particles from CSO205 were swept eastward soon after release. Particles from CSO203 moved east for the base configurations but remained between two protruding structures for all the other configurations. Even after 1-month, some particles are trapped near CSO200 and CSO201 for base and alternative configurations (figures15 and 16).

The distribution patterns of neutrally buoyant particles from 6-month and 5-year storm conditions were similar. The only visible distinction was the number of particles in the system—the number of particles from the 5-year storm was roughly double the one from the 6-month storm. After 1 month from release, a hot spot is visible in the Harbor near CSO200 for the base and all three alternative design configurations. For configurations 1 and 2, East 55th State Marina appears to be a hotspot though to a lesser degree than the water adjacent to CSO200. For configuration 3, Gordon Park Marina would be a possible secondary hot spot.

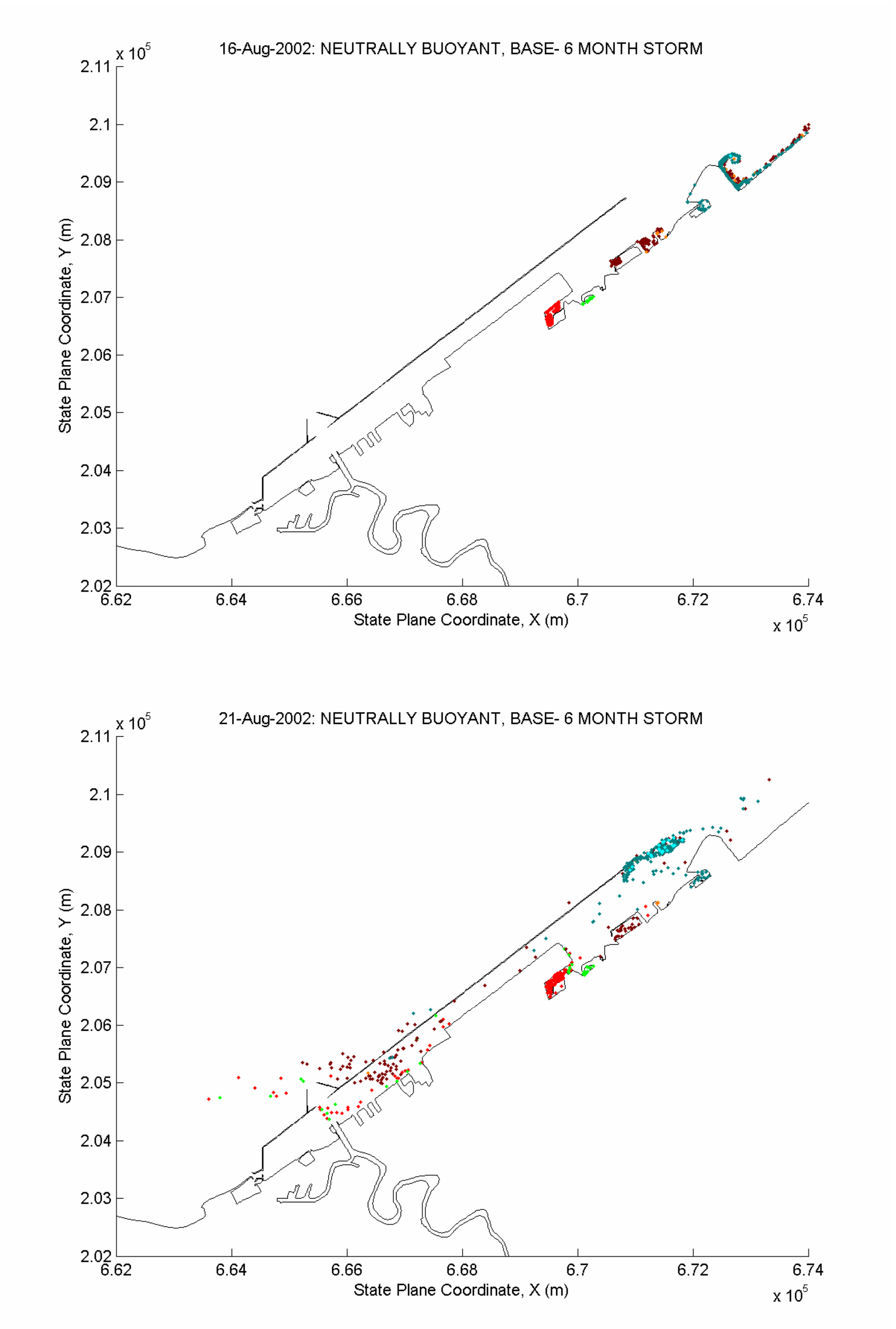
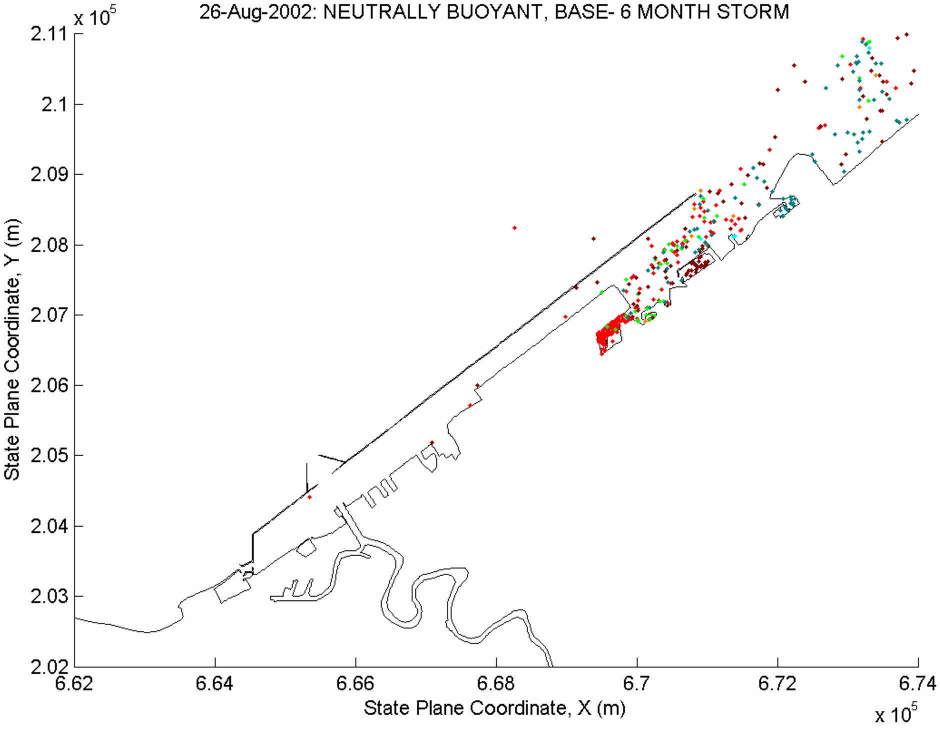


Figure 9. Particle position with time from 6-month storm (particles colored to differentiate CSO) – Base configuration (a and b)



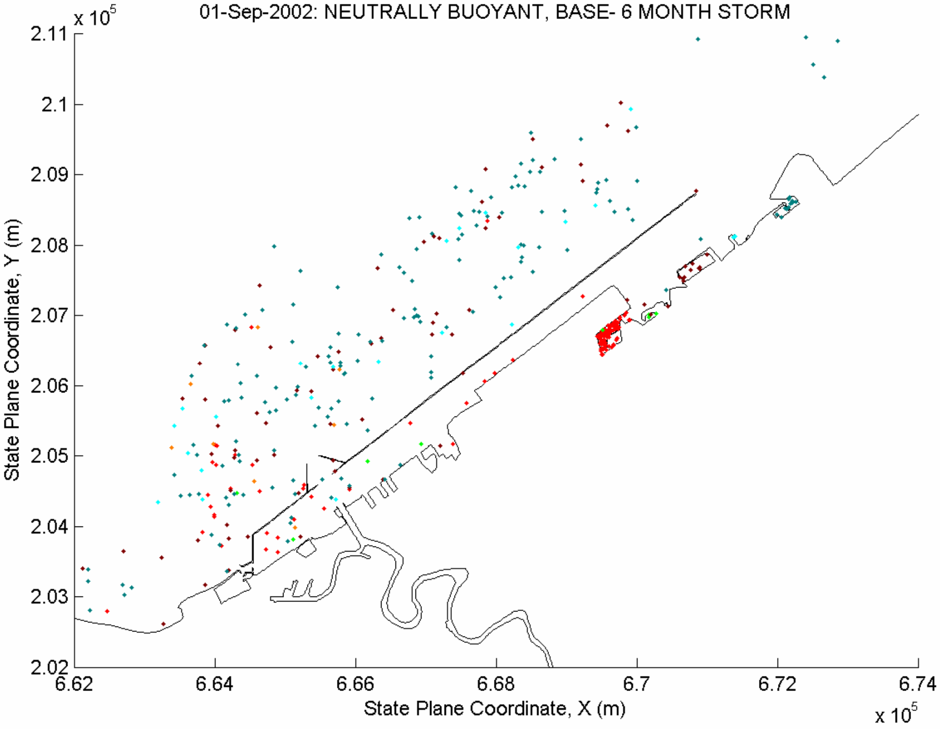


Figure 9. cont (c and d)

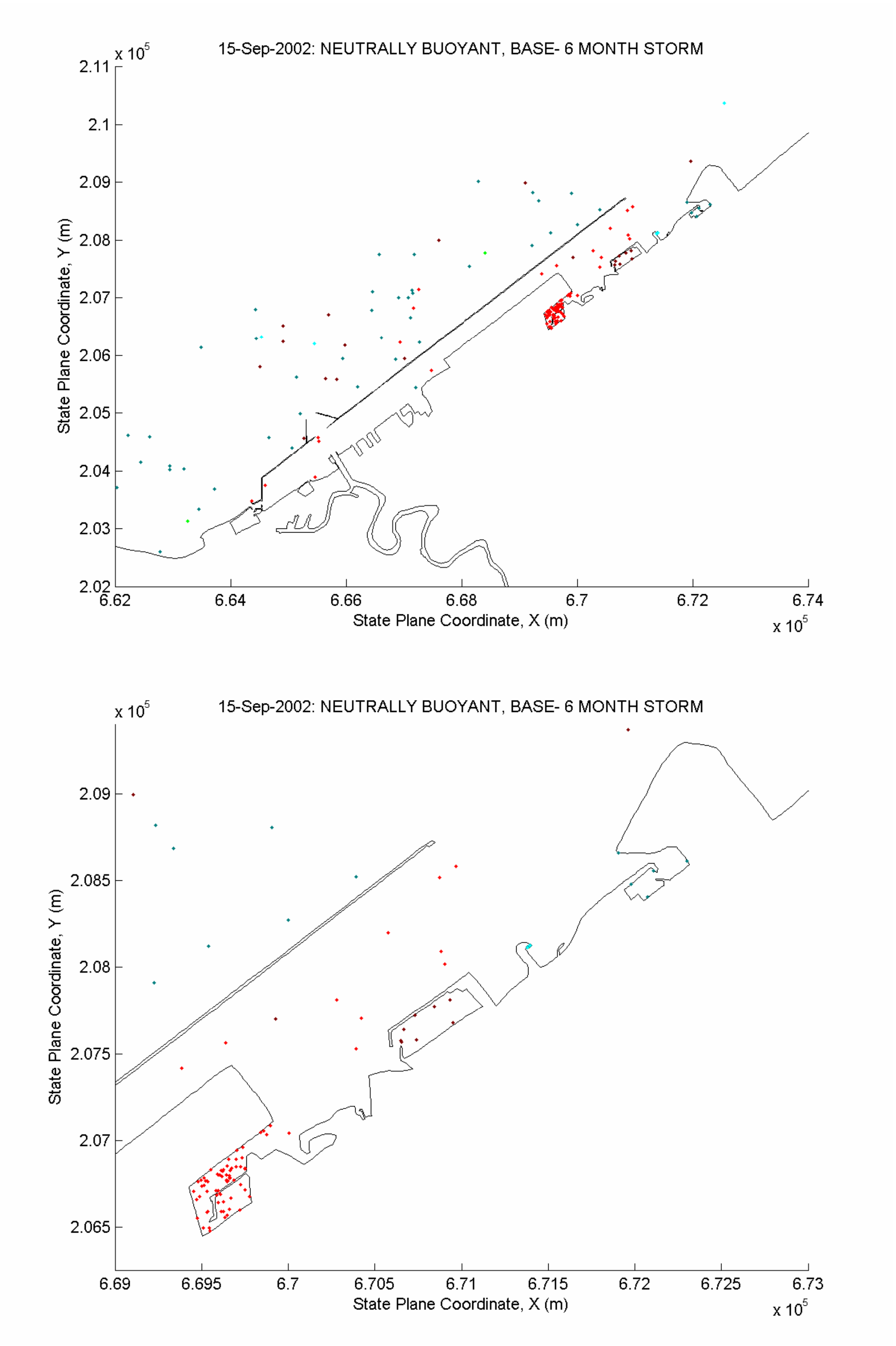


Figure 9. cont (e and f)

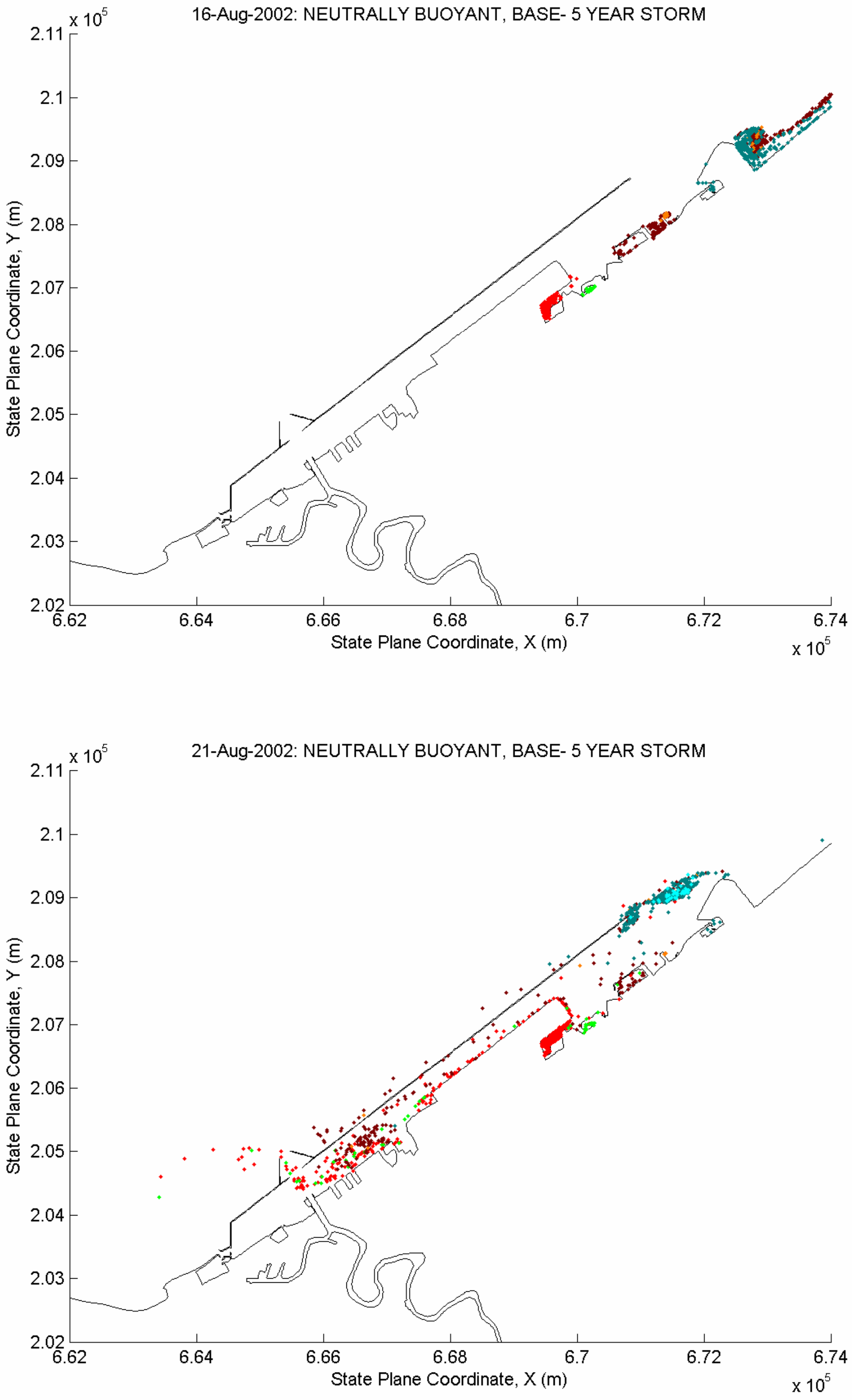


Figure 10. Particle position with time from 5-year storm (particles colored to differentiate CSO) – Base configuration (a and b)

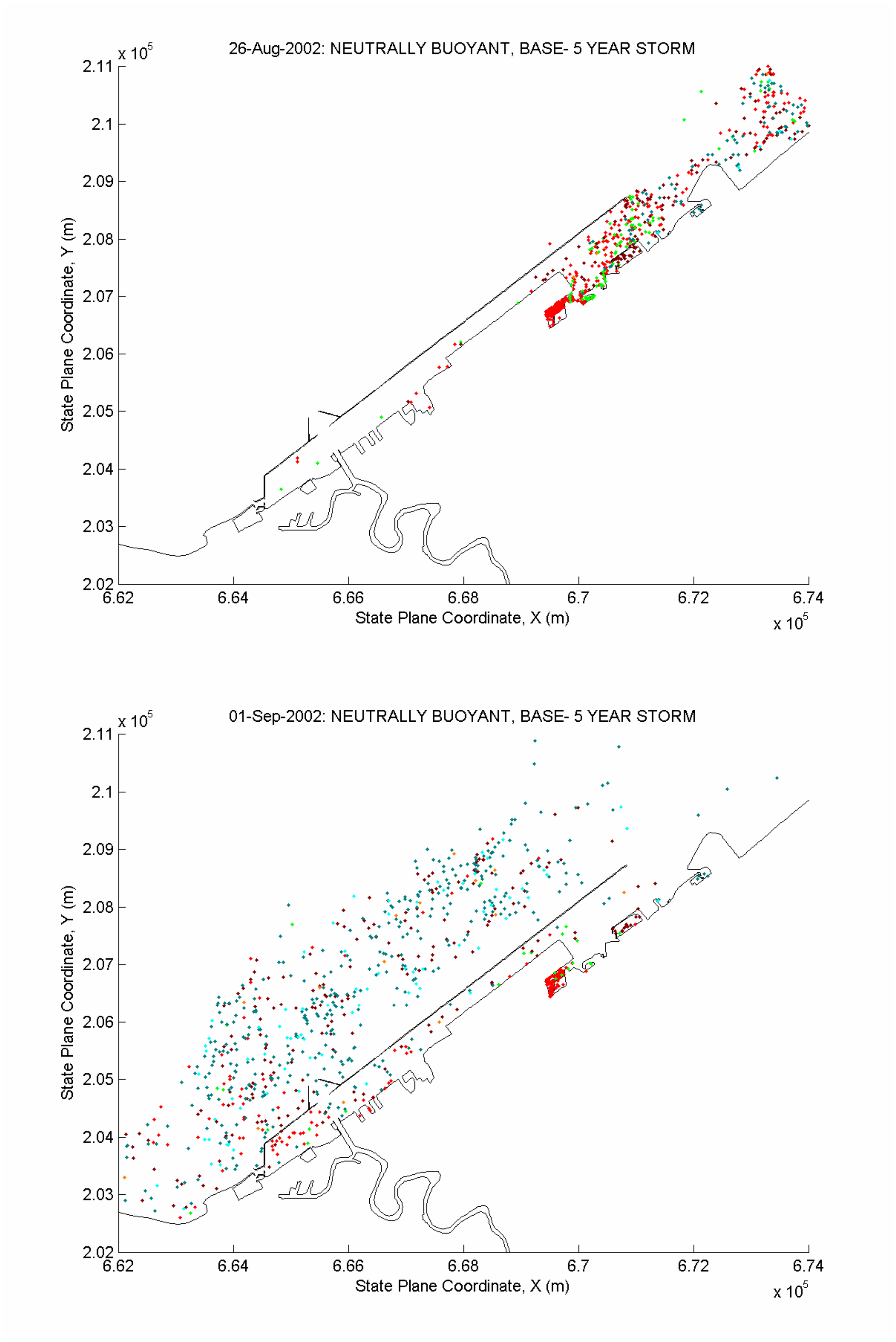


Figure 10. cont. (b and c)

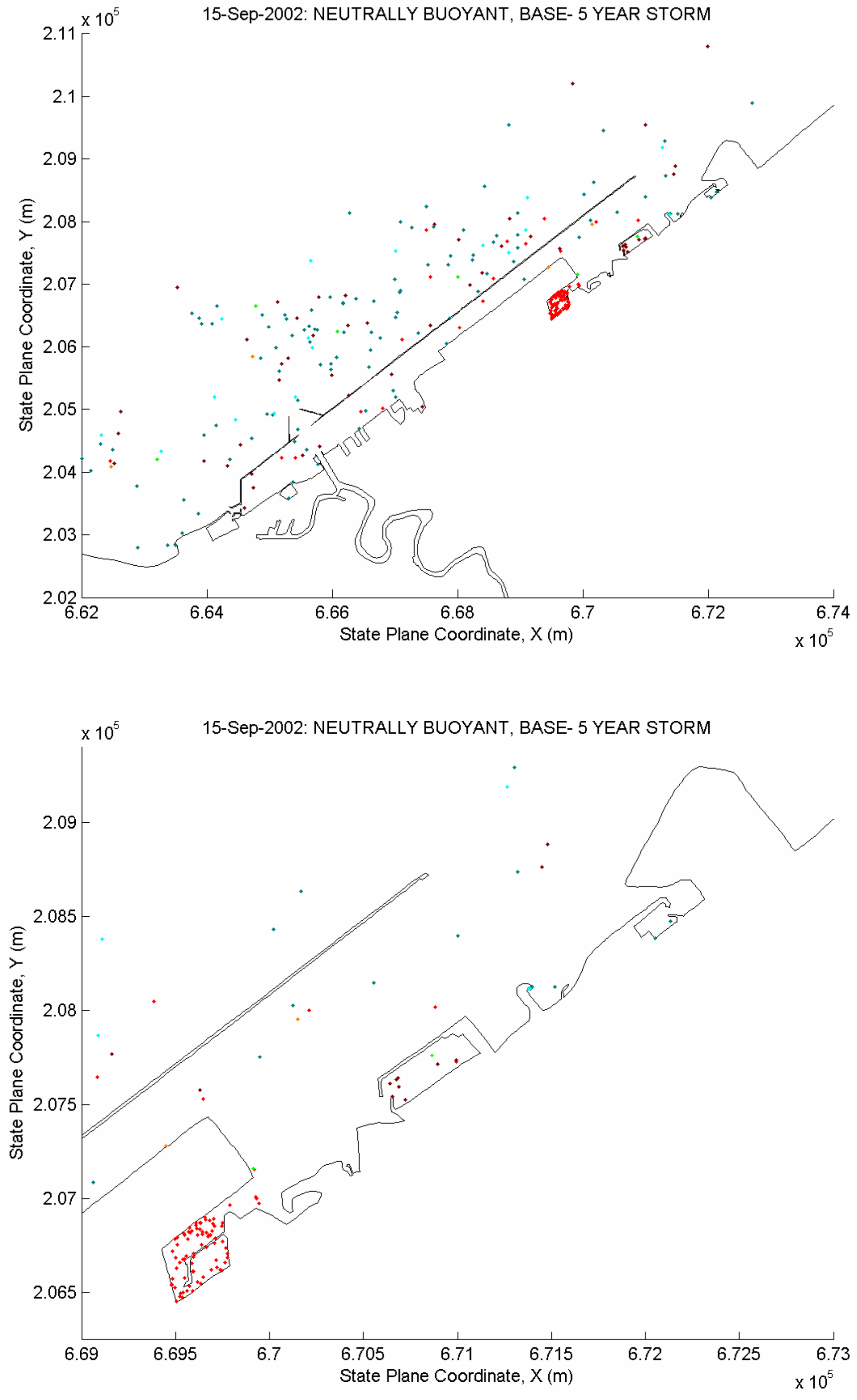


Figure 10. cont. (b and c)

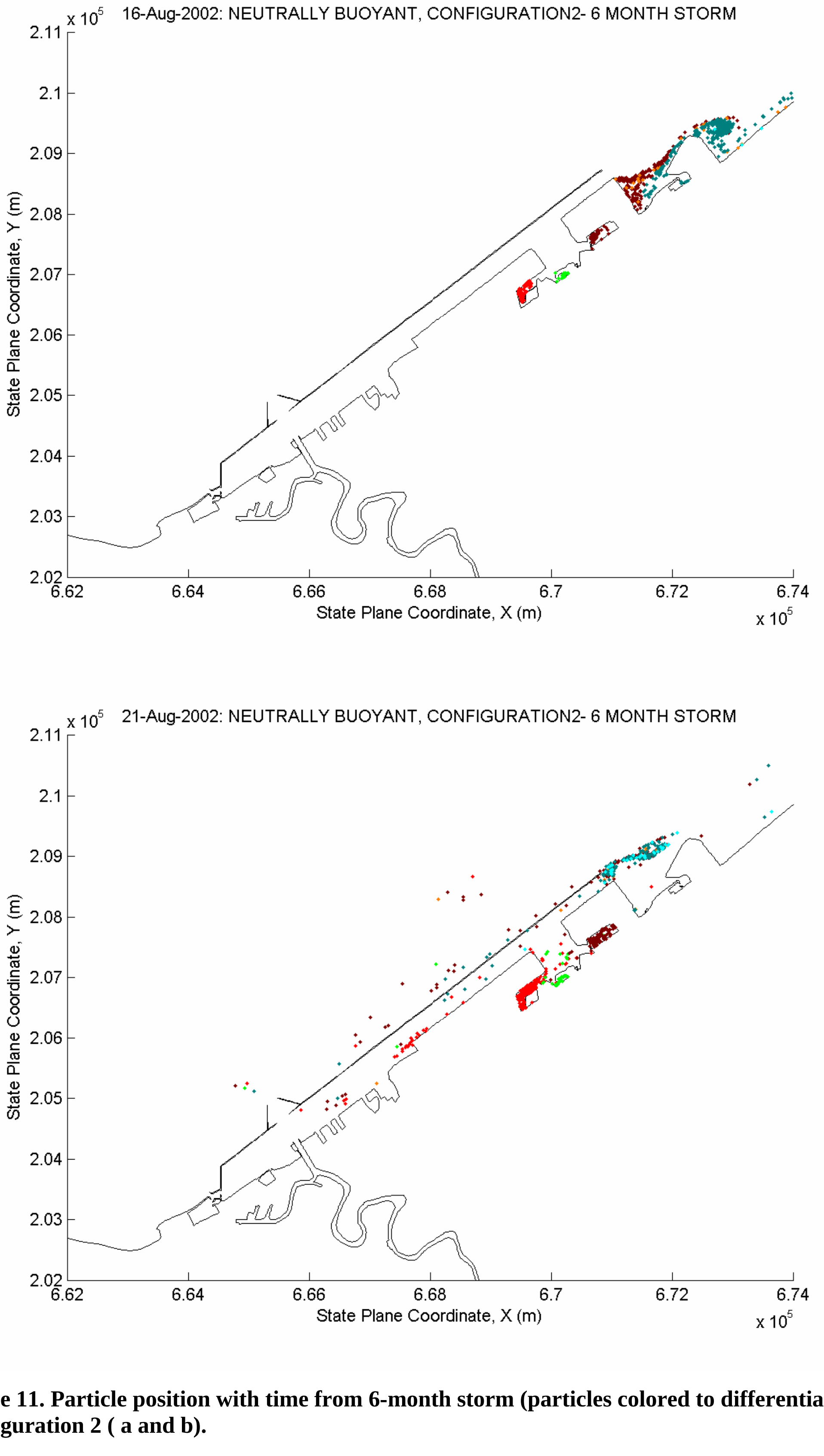
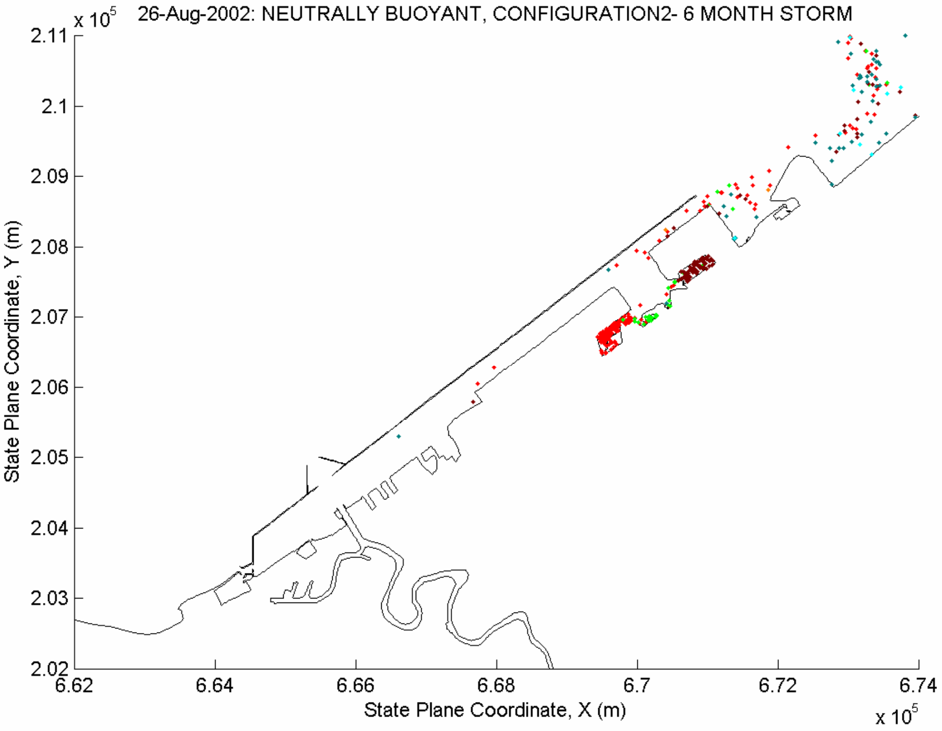


Figure 11. Particle position with time from 6-month storm (particles colored to differentiate CSO) – Configuration 2 (a and b).



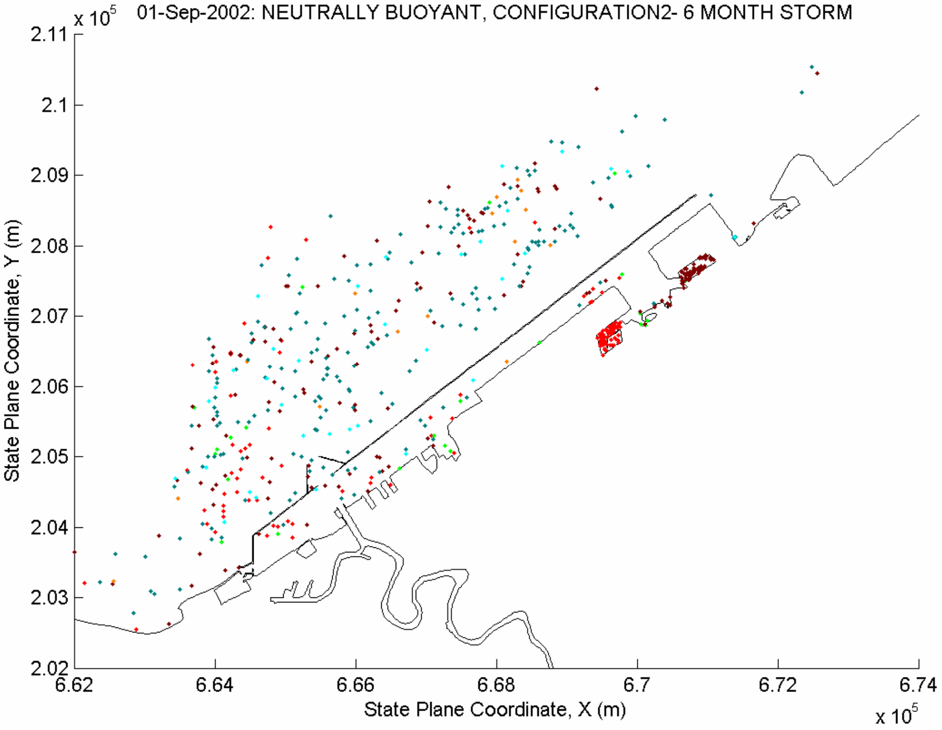


Figure 11 cont. (c and d).

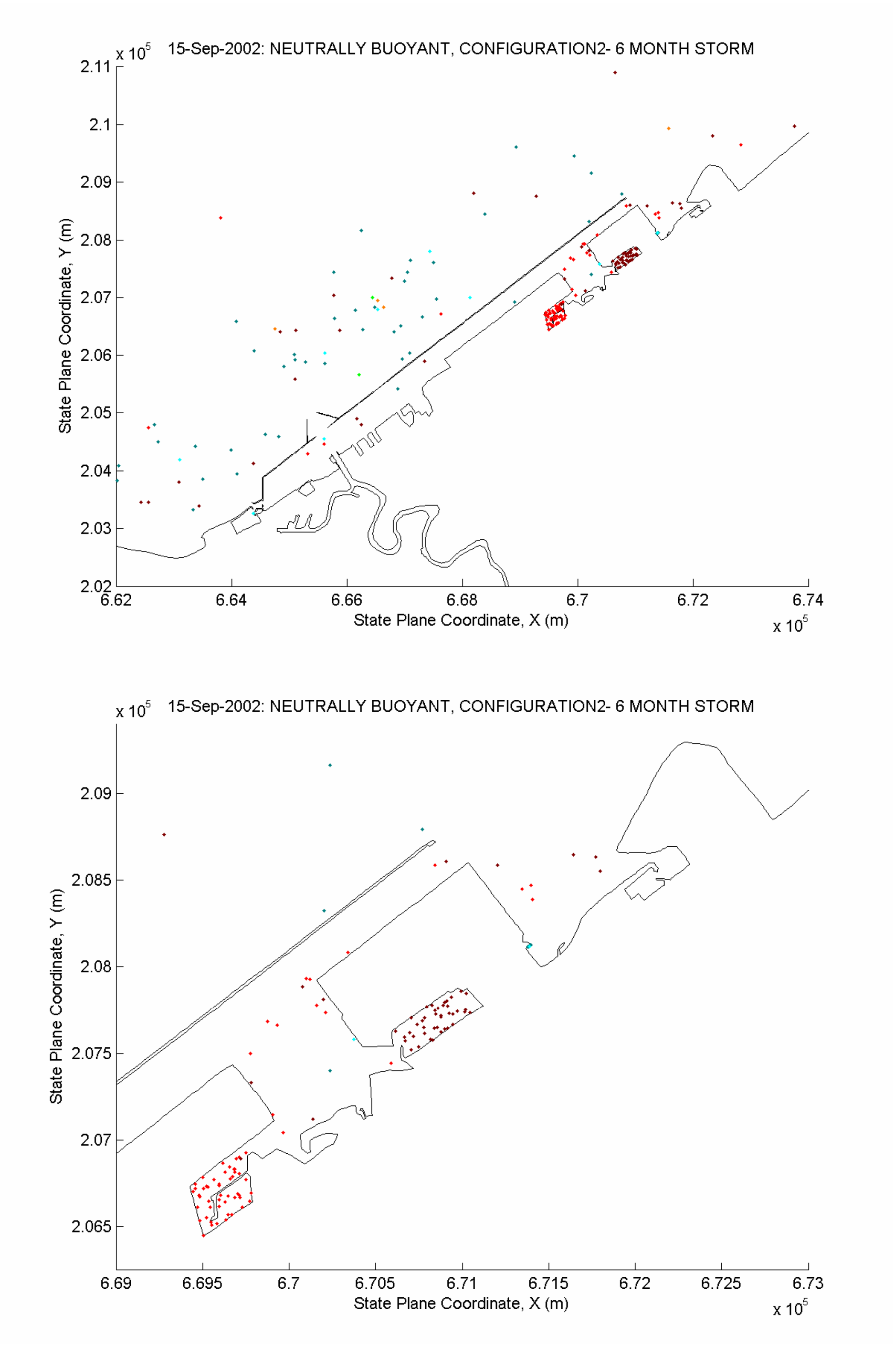
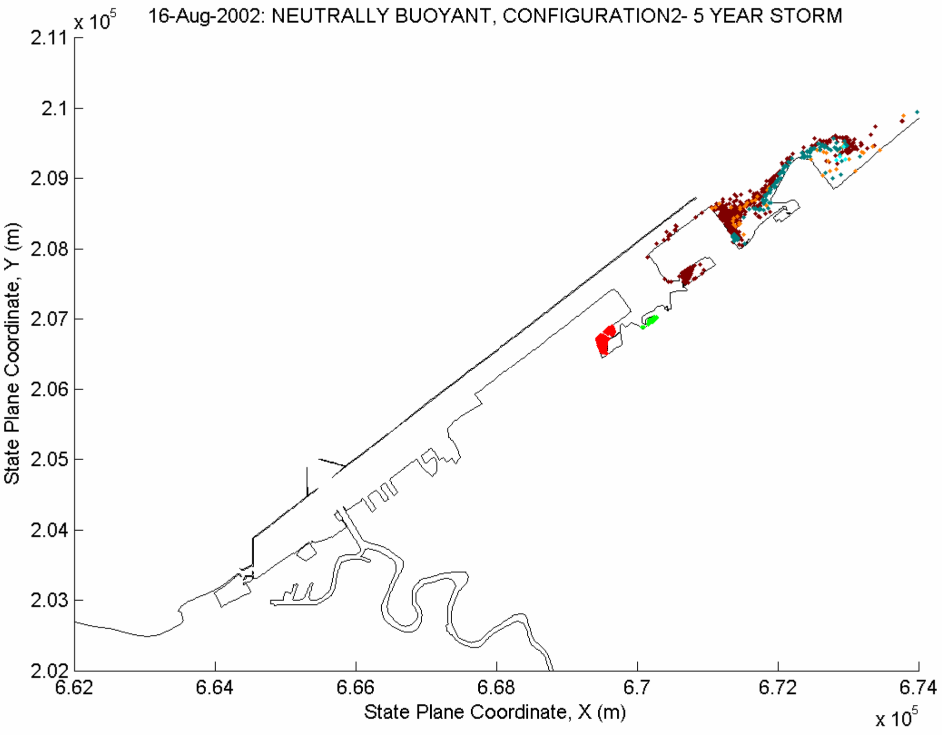


Figure 11 cont. (e and f).



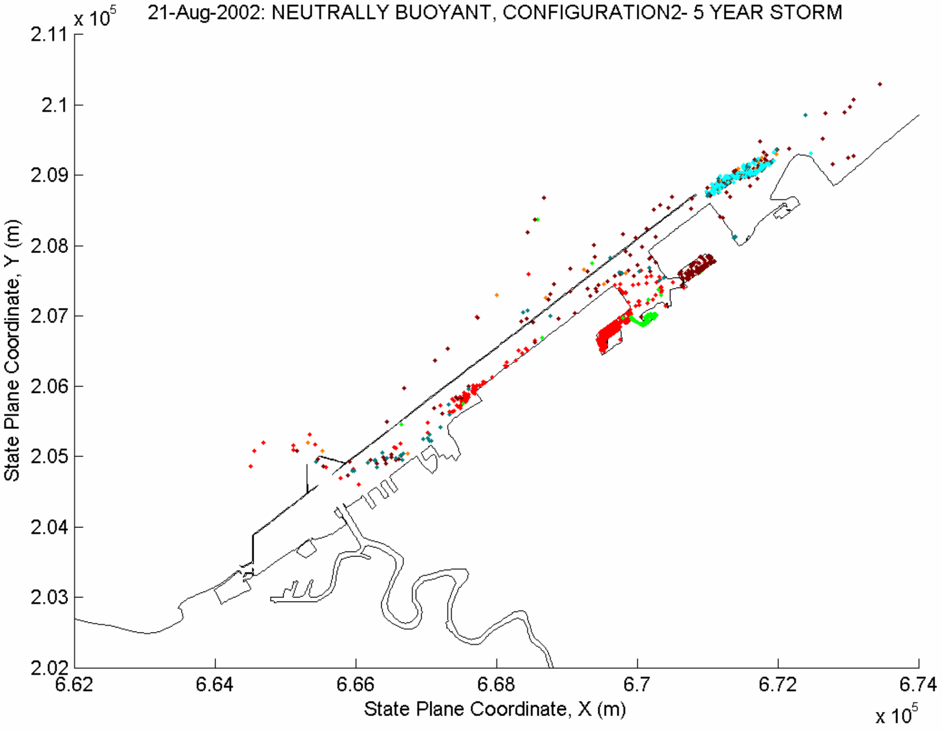
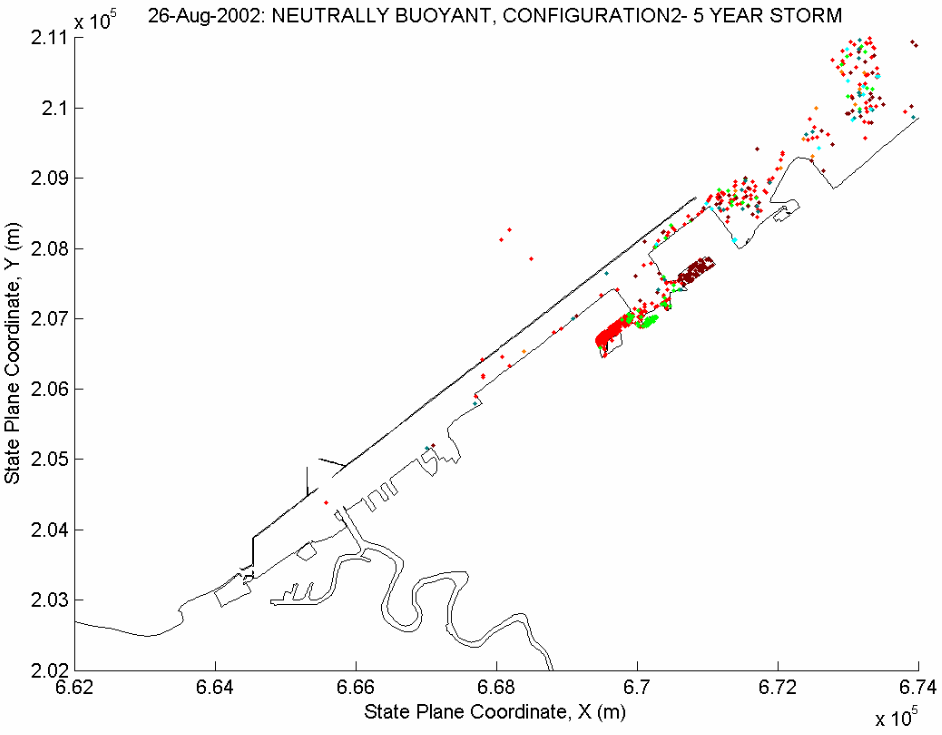


Figure 12. Particle position with time from 5-year storm (particles colored to differentiate CSO) – Configuration 2 (a and b)



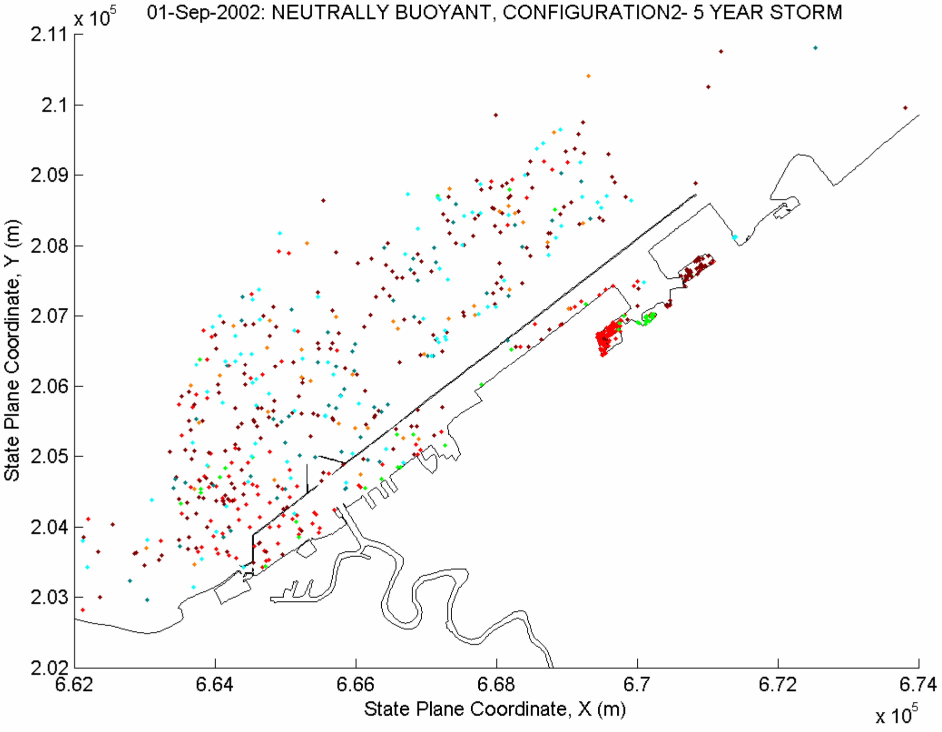
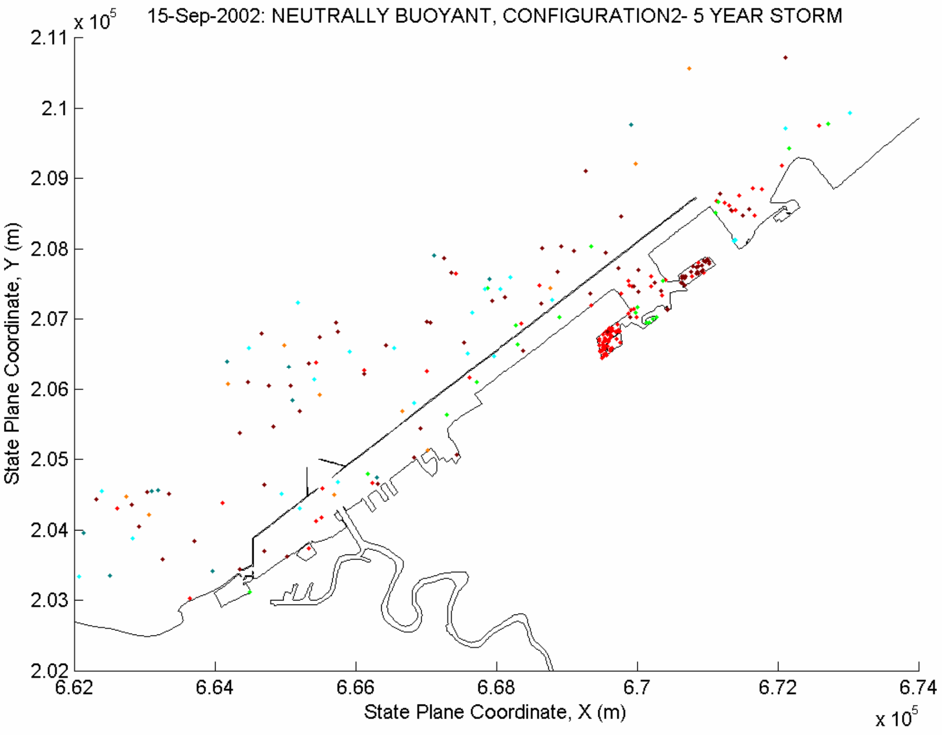


Figure 12. cont. (c and d).



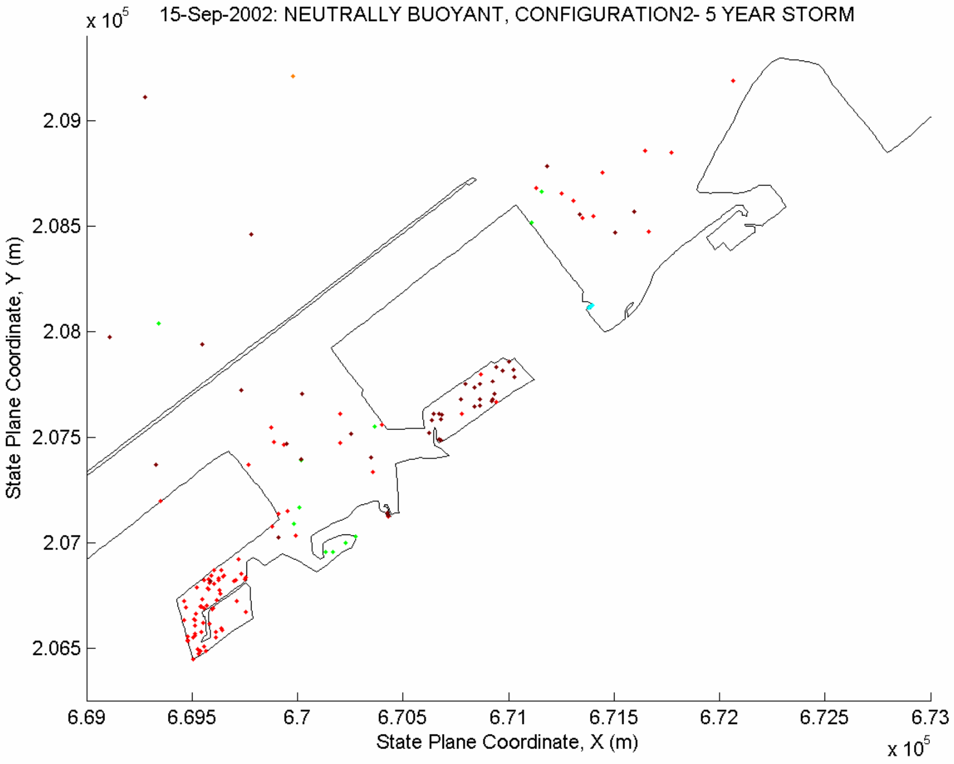


Figure 12. cont (e and f)

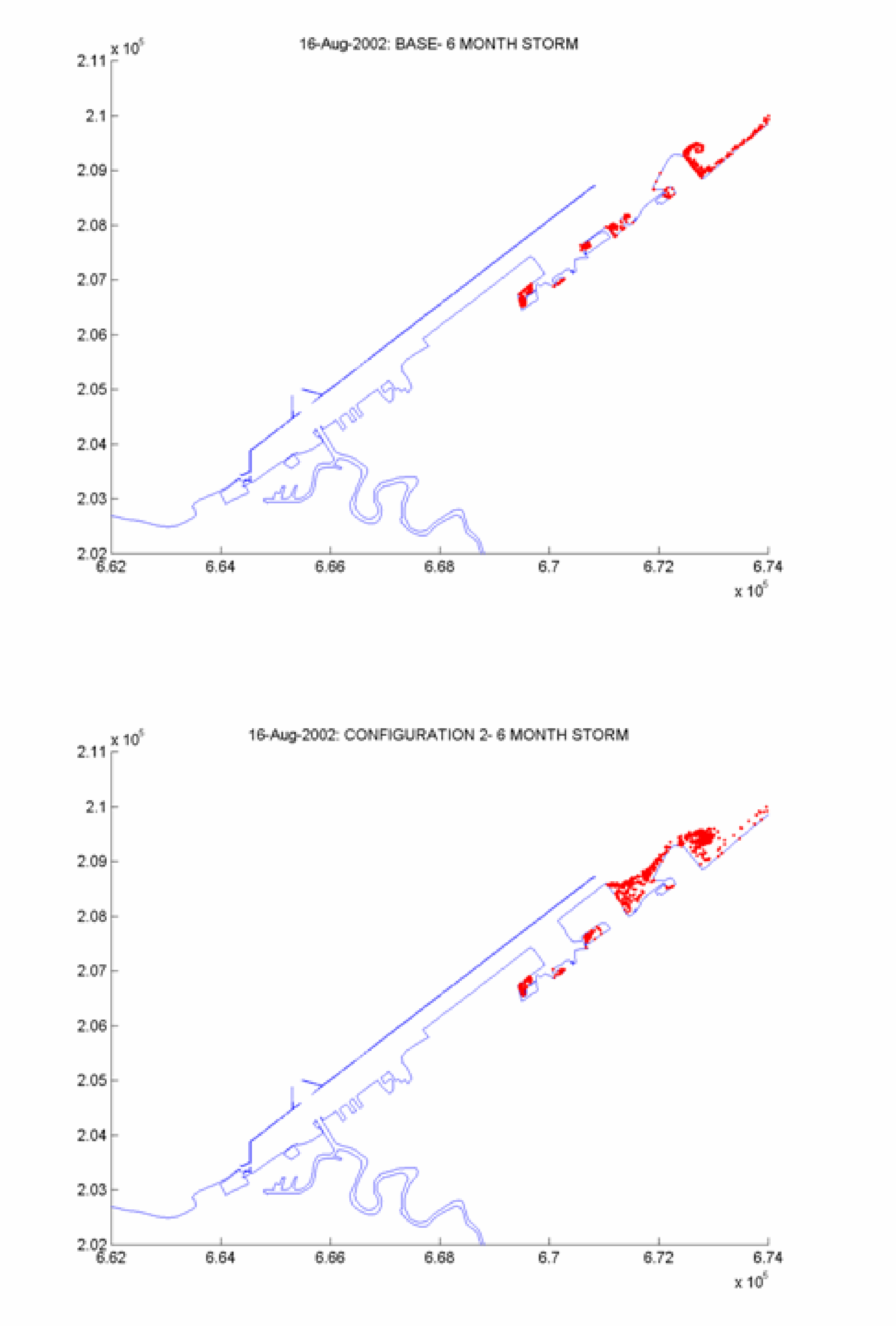
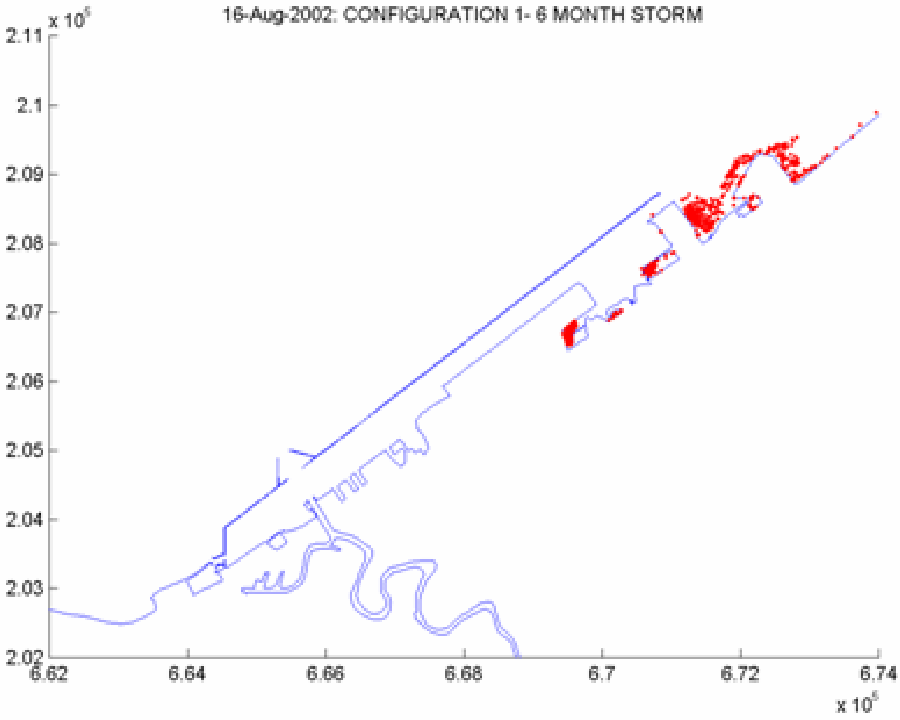


Figure 13. Particles around Cleveland Harbor 1 day after event from 6-month storm (a and b)



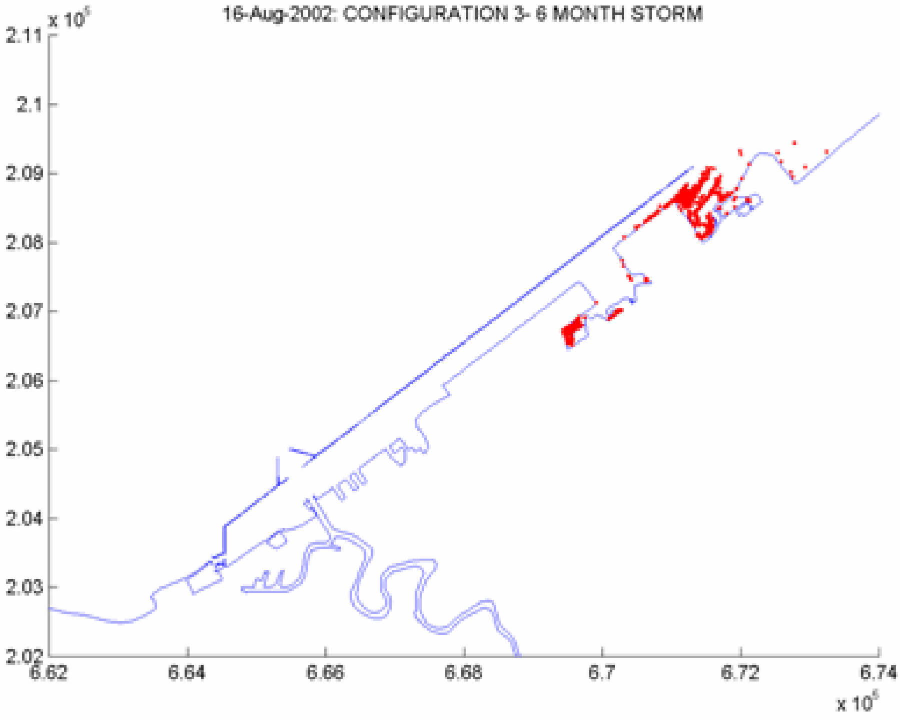


Figure 13. cont. (c and d)

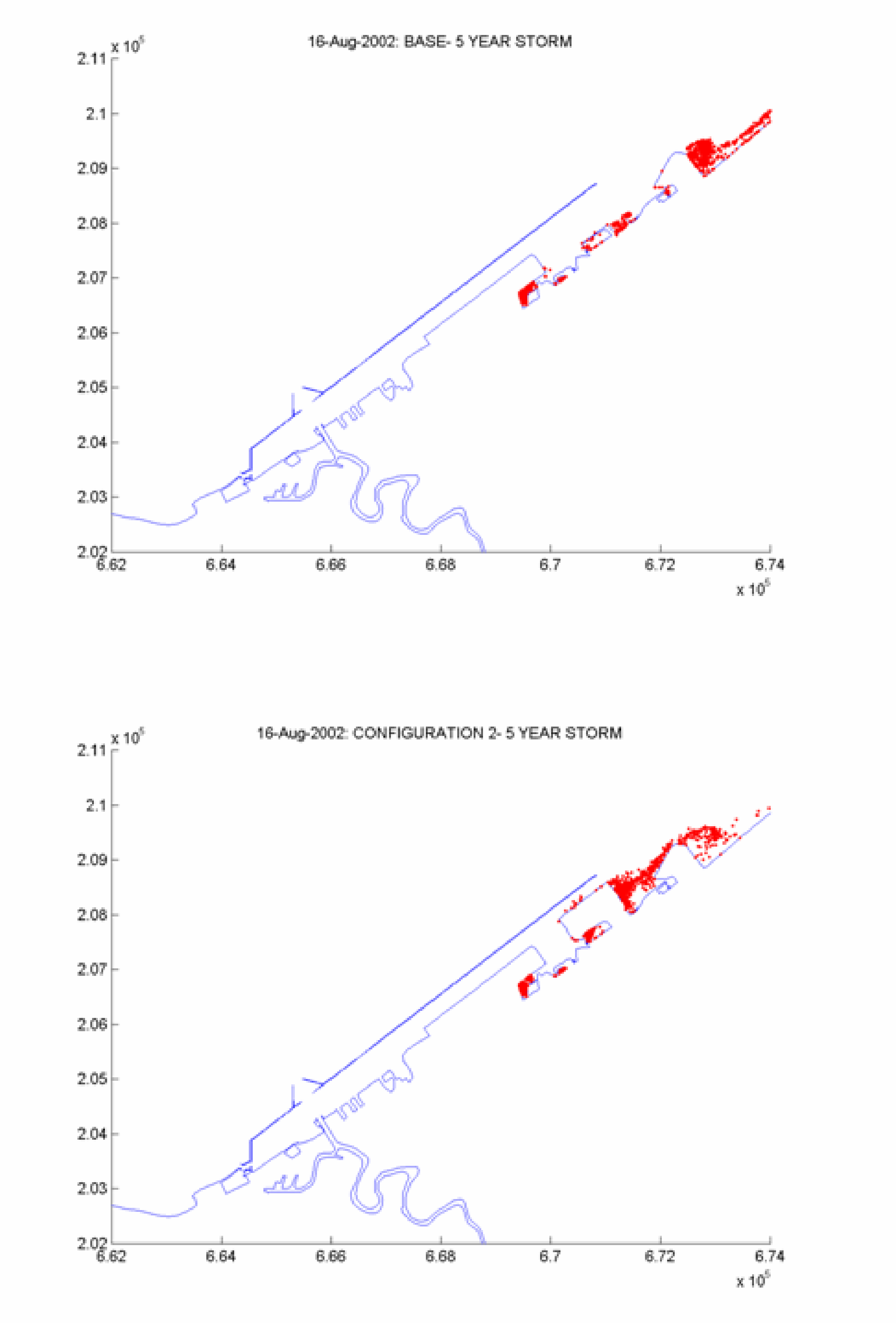


Figure14. Particles around Cleveland Harbor 1 day after event from 5-year storm (a and b)

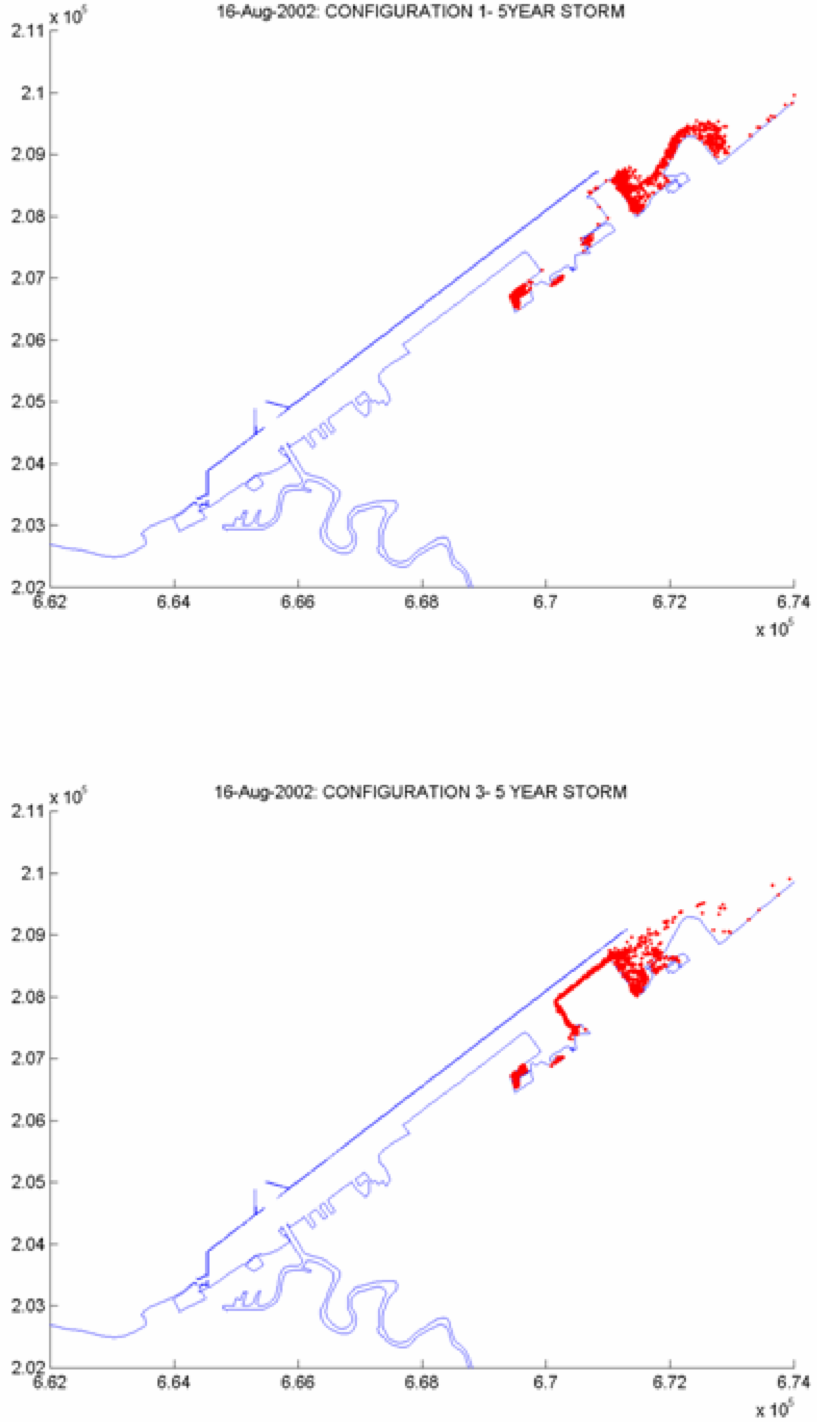


Figure14. cont. (c and d)

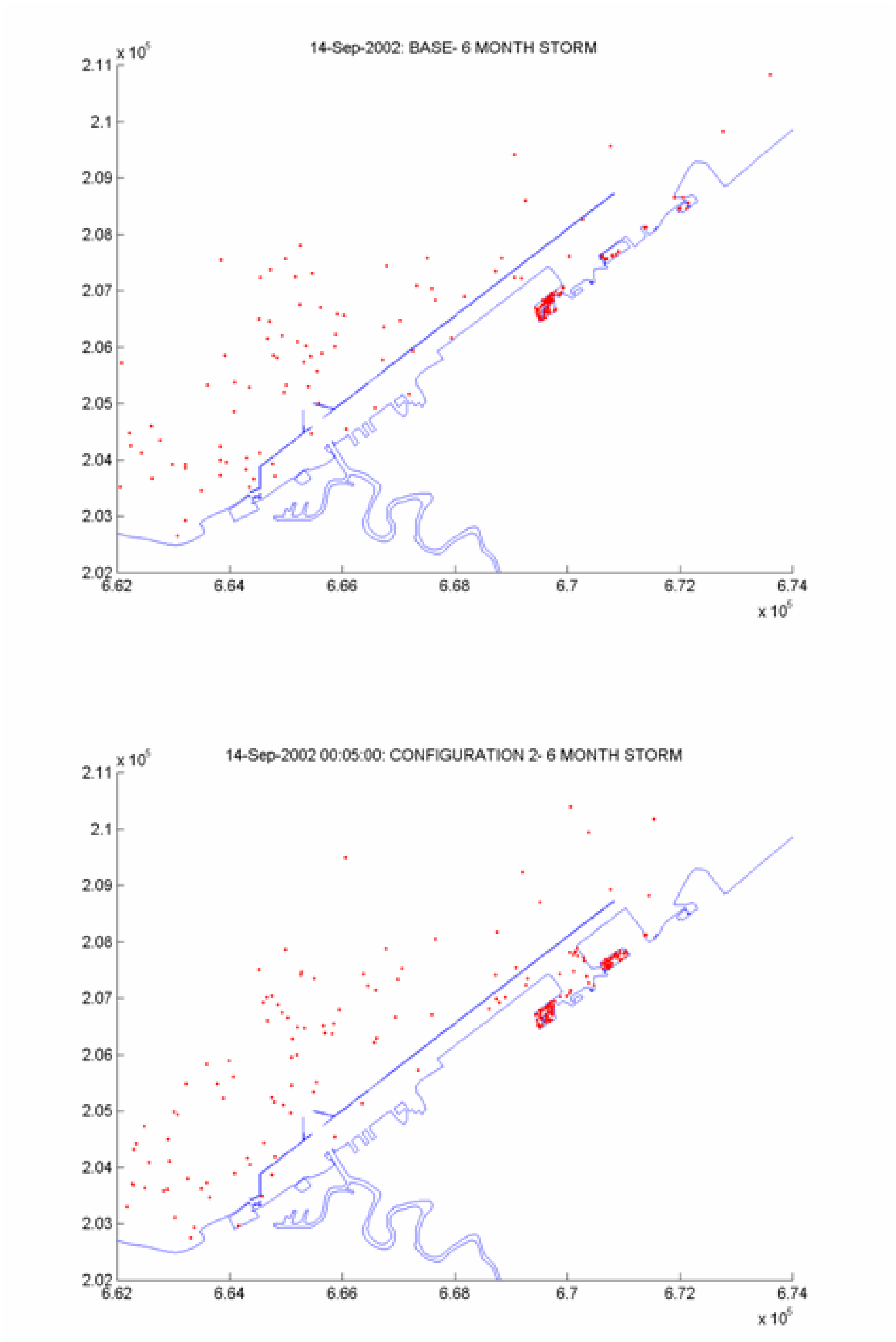


Figure 15. Particles around Cleveland Harbor 1 month after event from 6-month storm (a and b)

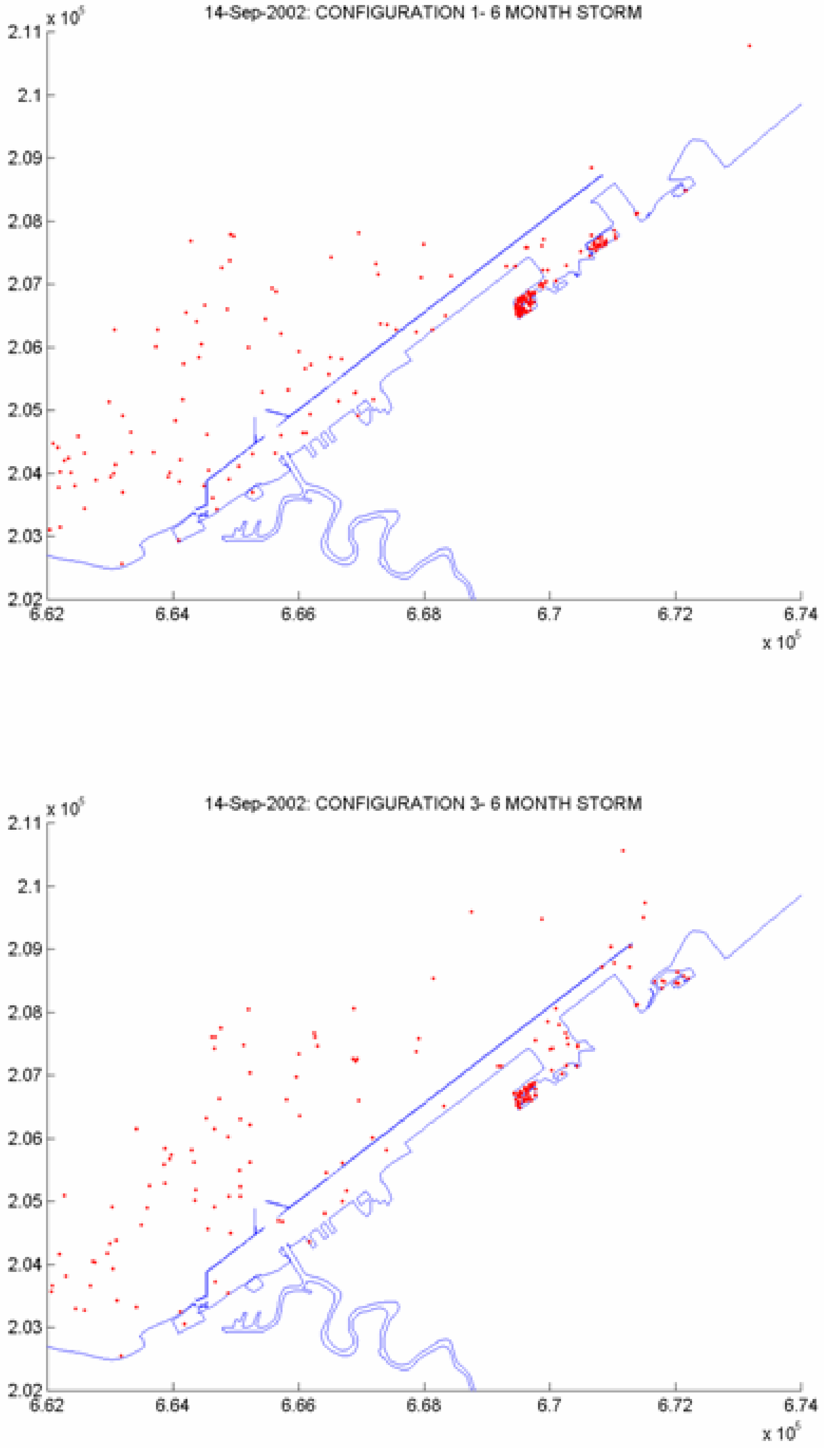


Figure 15. cont (c and d).

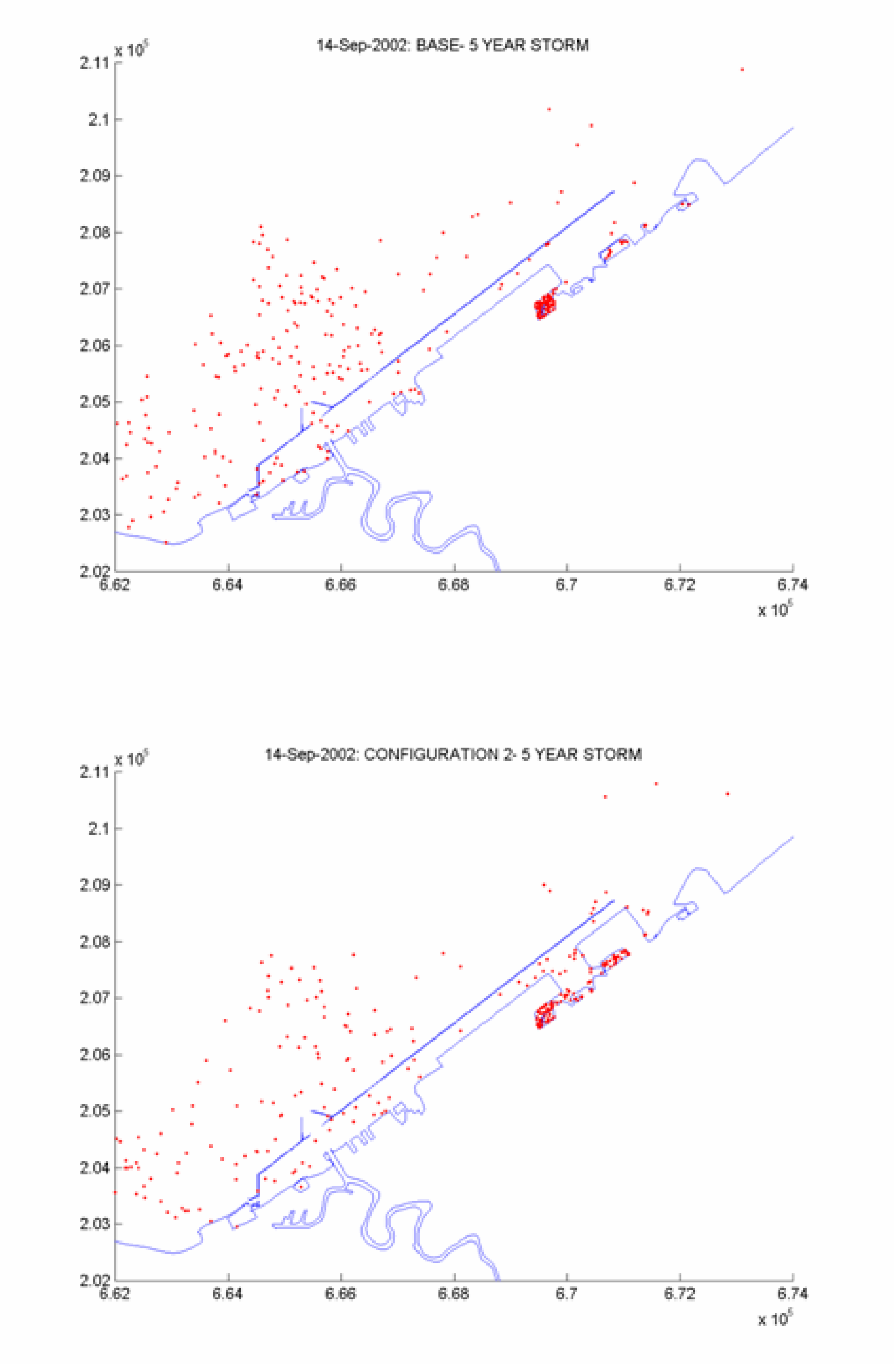


Figure16. Particles around Cleveland Harbor 1 month after event from 5-year storm (a and b).

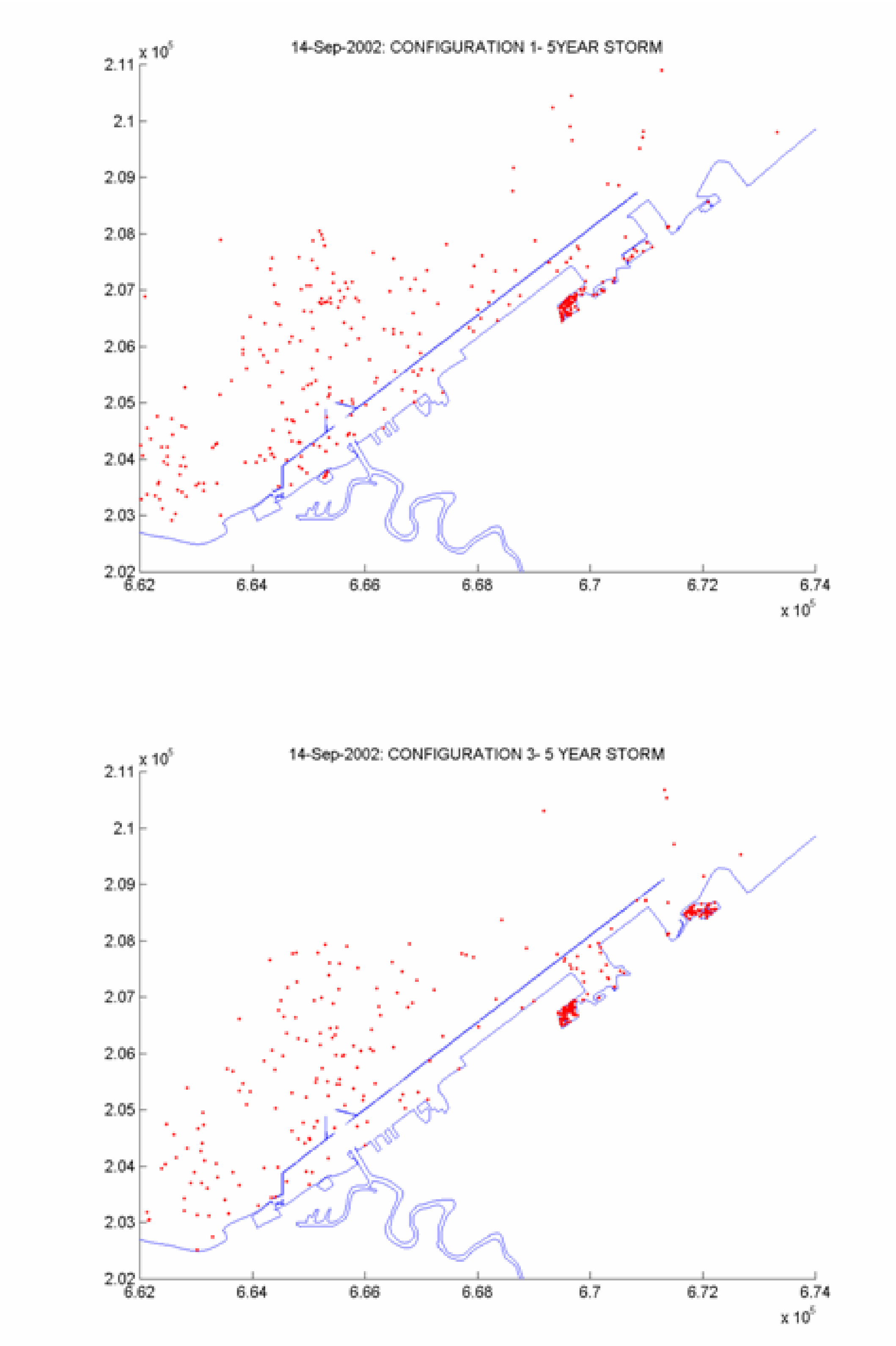


Figure16. cont. (c and d).

Debris Study (Floatable Particles)

Floatable particles are representative of floating debris in the harbor. In the case of floatables, wind effects became a key factor to particle transport. To add this attribute to PTM, particle velocities were treated in a slightly different method than the neutrally buoyant particles. Within PTM, the horizontal particle velocities are primarily determined by the summation of the advection velocity and diffusion velocity. For floatables, a wind velocity vector was added to the hydrodynamic velocity forcing.

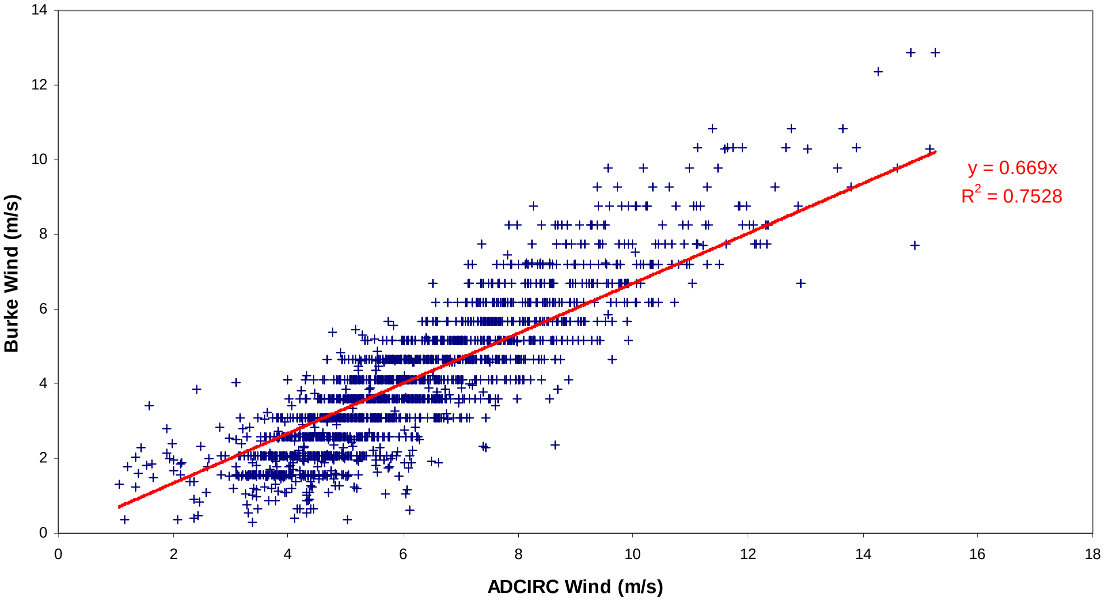


Figure 17. Comparison of observed wind at Burke Airport and ADCIRC model wind

$$\vec{v} = \vec{v} + K_w \vec{U} \tag{1}$$

Here, $\vec{U}$ is wind velocity vector measured at 10 m. The typical coefficient for K_w is 0.03. Observed winds at Burke Airport are about 70 percent of ADCIRC model winds (figure 17), which gives K_w = 0.02 when we use ADCIRC winds. The value of 0.3 for K_w is for open ocean wind. Cleveland Harbor is sheltered so that the K_w would be smaller than 3 percent. We use 1 percent in this study.

The results of the debris study were drastically different than the chemical transport study. Floatables exited the harbor rapidly. Figure 18 shows particles as they are being released during the storm event. Southwesterly winds took the particles eastward during this event. Most of the particles moved away from the Harbor 1 day after this period (figure 19). These results remain consistent for all configurations and for both storms.

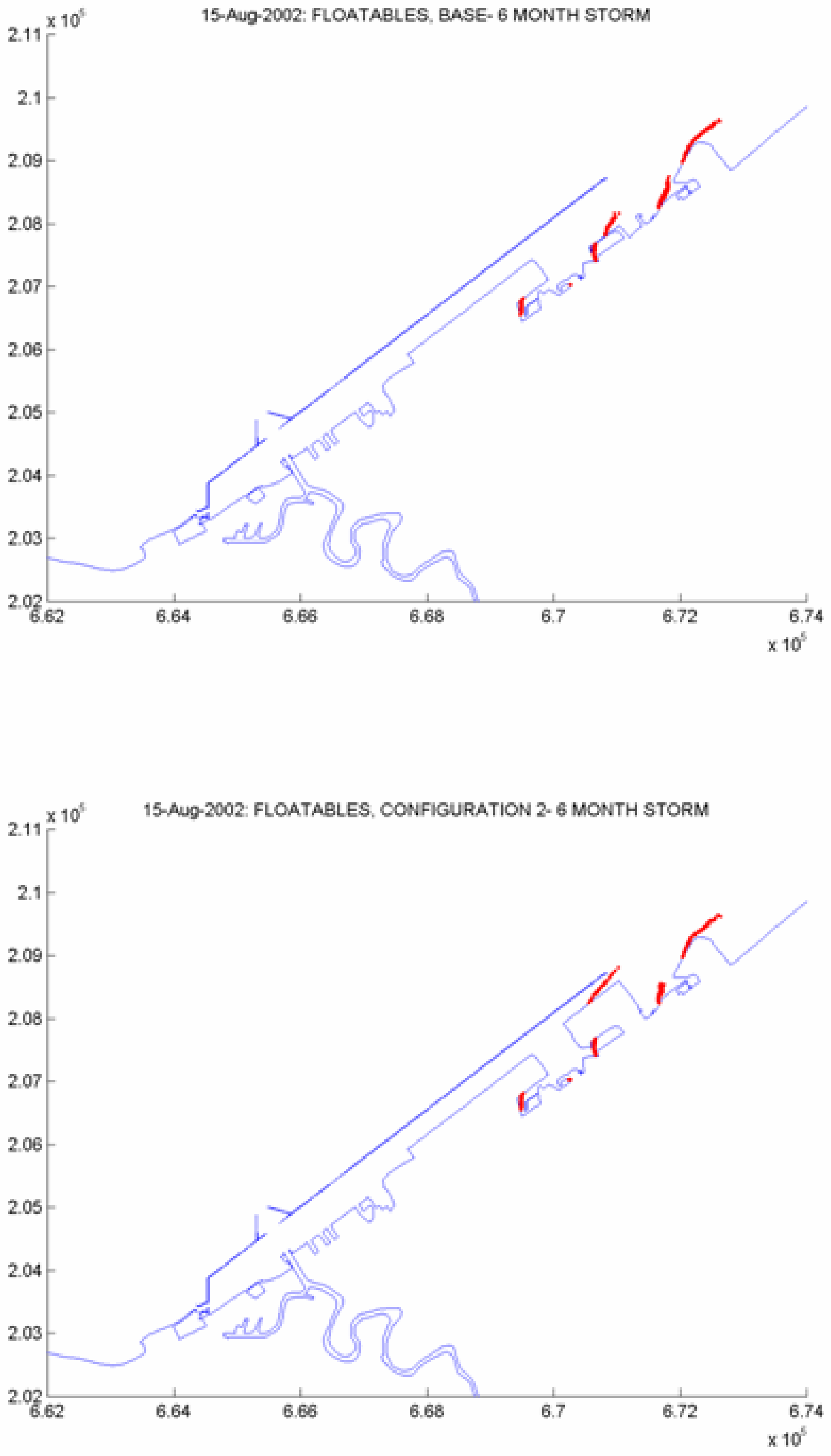


Figure18. Floatables around Cleveland Harbor during event from 6-month storm (a and b)

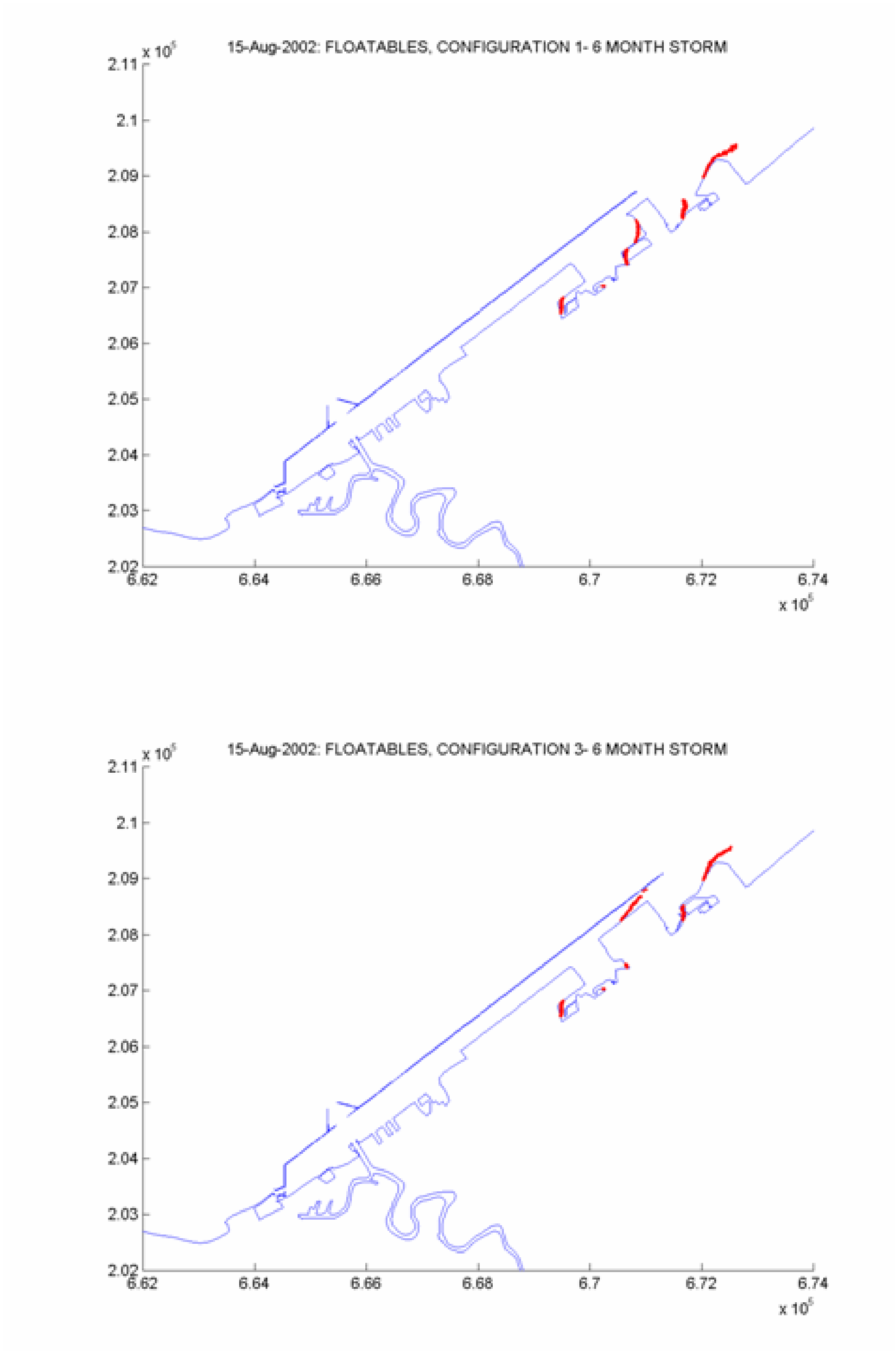


Figure18. cont. (c and d)

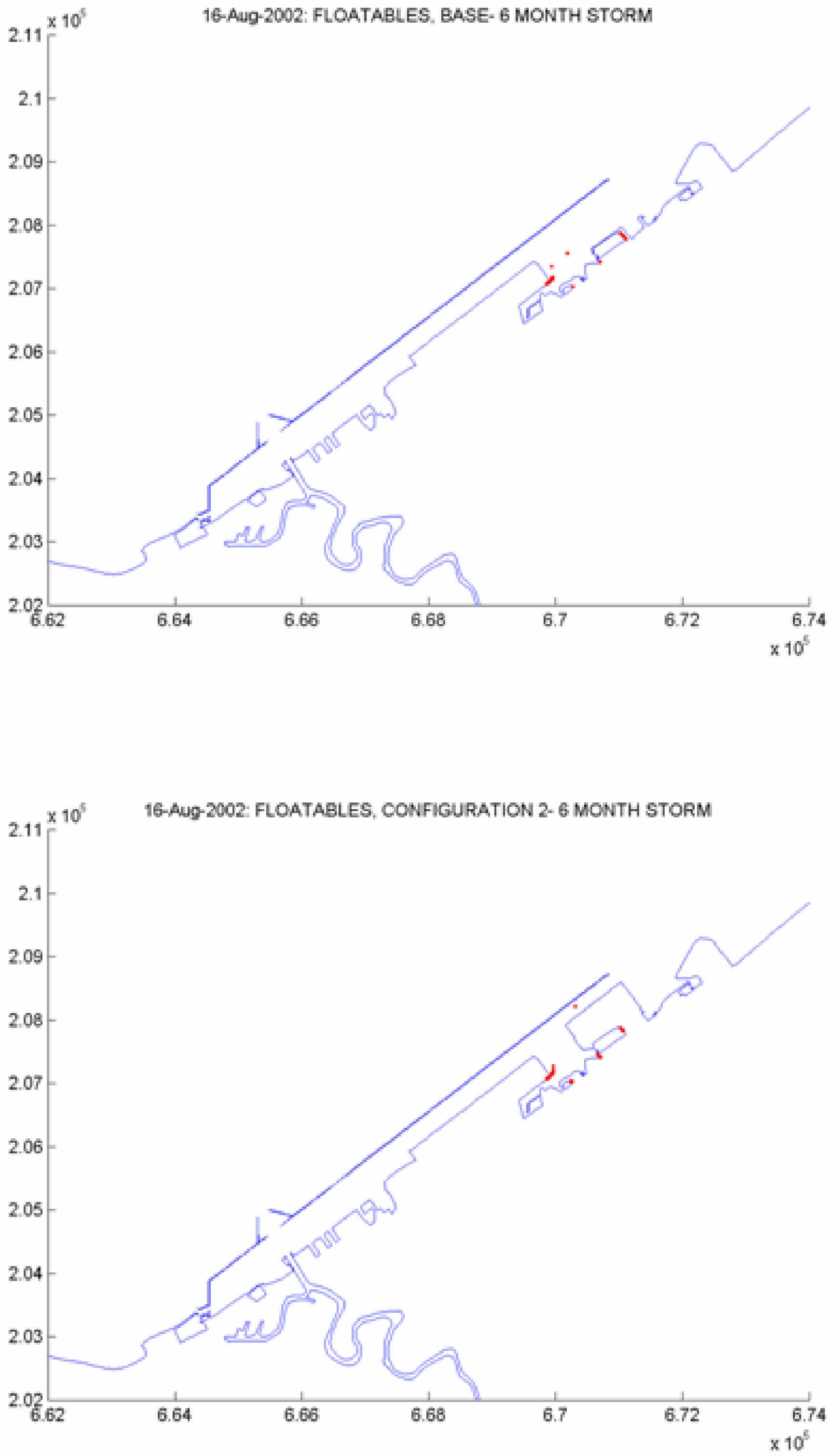


Figure19. Floatables around Cleveland Harbor 1 day after event from 6-month storm (a and b)

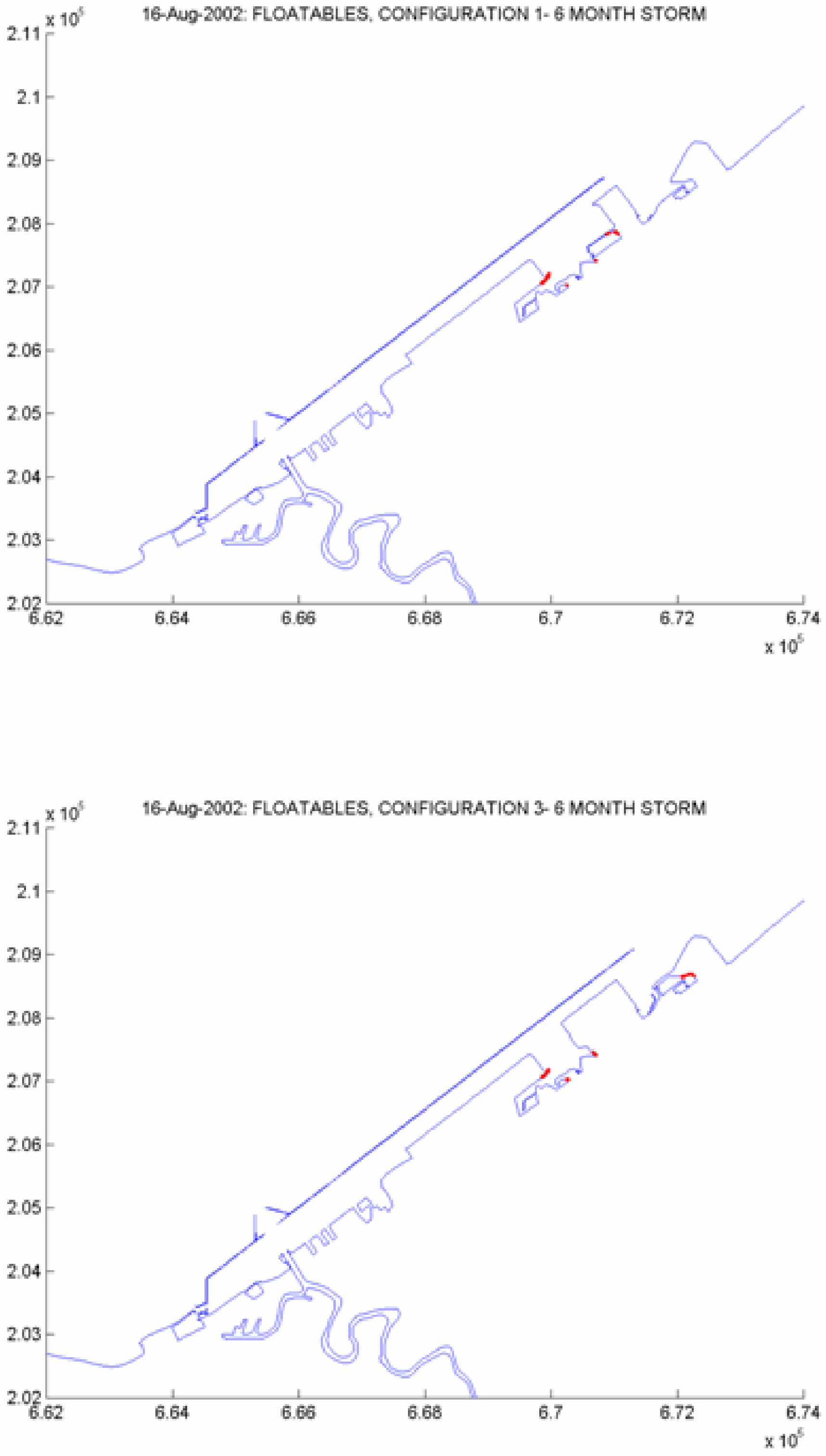


Figure19.cont (c and d)

Sediment Study

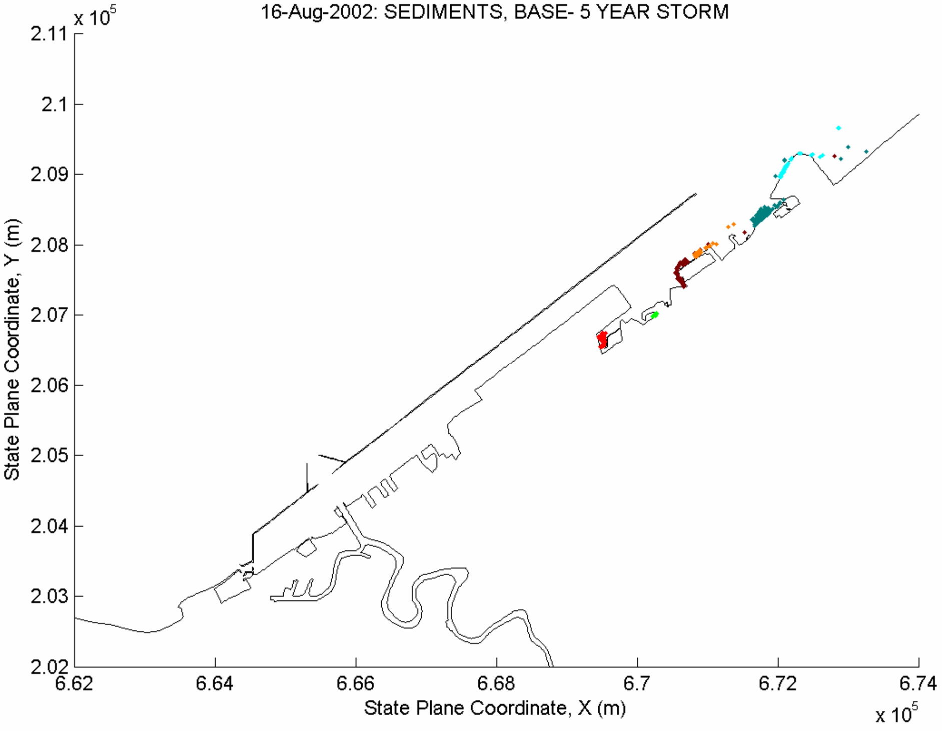
A brief study of sediment transport was performed using PTM. A more extensive near bed sediment study using GTRAN (SOW Task 6) has also been planned. In this PTM study, fine grain sediment (D50 = 100 microns) was discharged from the CSOs. Due to lack of data, the approach taken was a dimensionless sediment source. The mass rate of sediment entering at each CSO was taken as proportionate to the discharge rate of the CSO.

$$R = Qx10^{-1}$$

In this case R is the rate of sediment discharge and Q is the discharge rate of the CSO. If future data on the actual percentage of sediment to discharge is determined, then all values can be adjusted by the new factor.

A difference between the previous two cases of neutrally buoyant and floatable particles is that during sediment transport settling and resuspension processes become important. The distinction between this case and the previous cases is immediately visible. The transportation of sediment particles is not nearly as diffusive as in the neutrally buoyant particle case. Initially, a portion of the particles are transported away from the CSOs. These particles are then transported by the flow away from the harbor region. For the most part, even at this stage the particles that are transported are less spread out. But most important is that it is also evident that due to settling and recirculating patterns near many of the CSOs caused by the structures in the vicinity of outfalls, a large percentage of the suspended sediment is allowed to quickly settle in reasonably tight formations. Shown in figures 20a-20f are snapshots of sediment particle positions with time from the 5 year storm utilizing the base configuration. Initially (figure 20a) after one day the sediment that does not immediately settle is transported away from the CSOs. However, quickly (20b-c) it is obvious that a significant portion remains in a clustered tight formation. After a months time (20f) it can be seen that more sediment has been resuspended and transported outside of the immediate region of the CSO.

This trend is followed in the case of the configuration 2 (figure 21). However in this case because of the CDF, there are more areas of recirculating flow and therefore more areas of settled particles. Also noticeable in the figures are areas where particles do not seem to resuspend suggesting that enough time has passed that there is a great probability of burial by bed sediment.



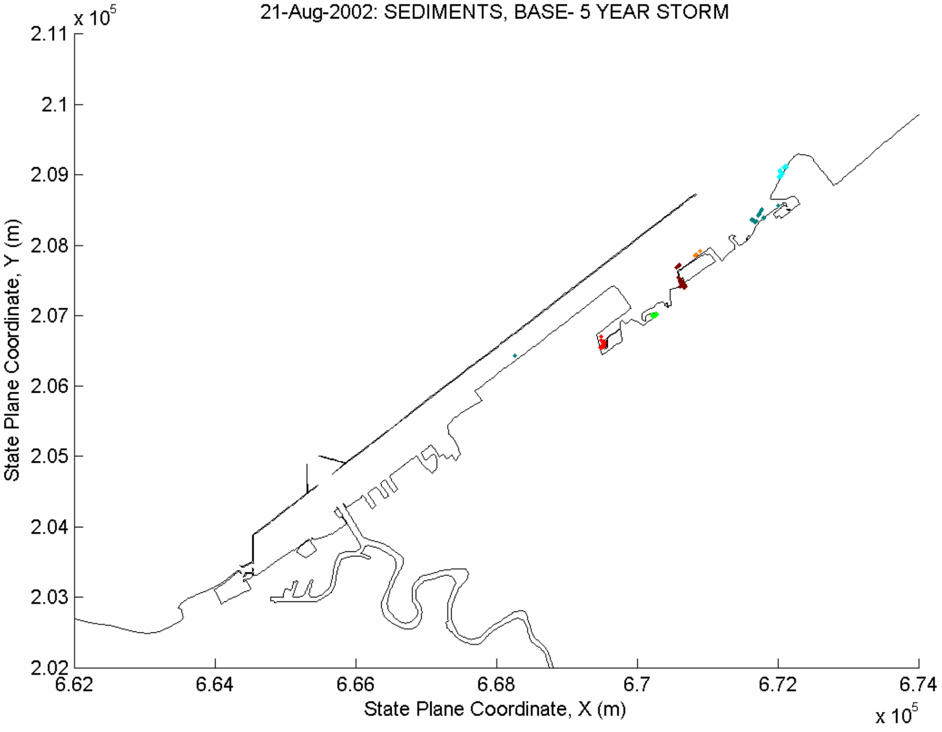


Figure 20. Sediment particle position with time from 5-year storm (particles colored to differentiate CSO) –Base (a and b)

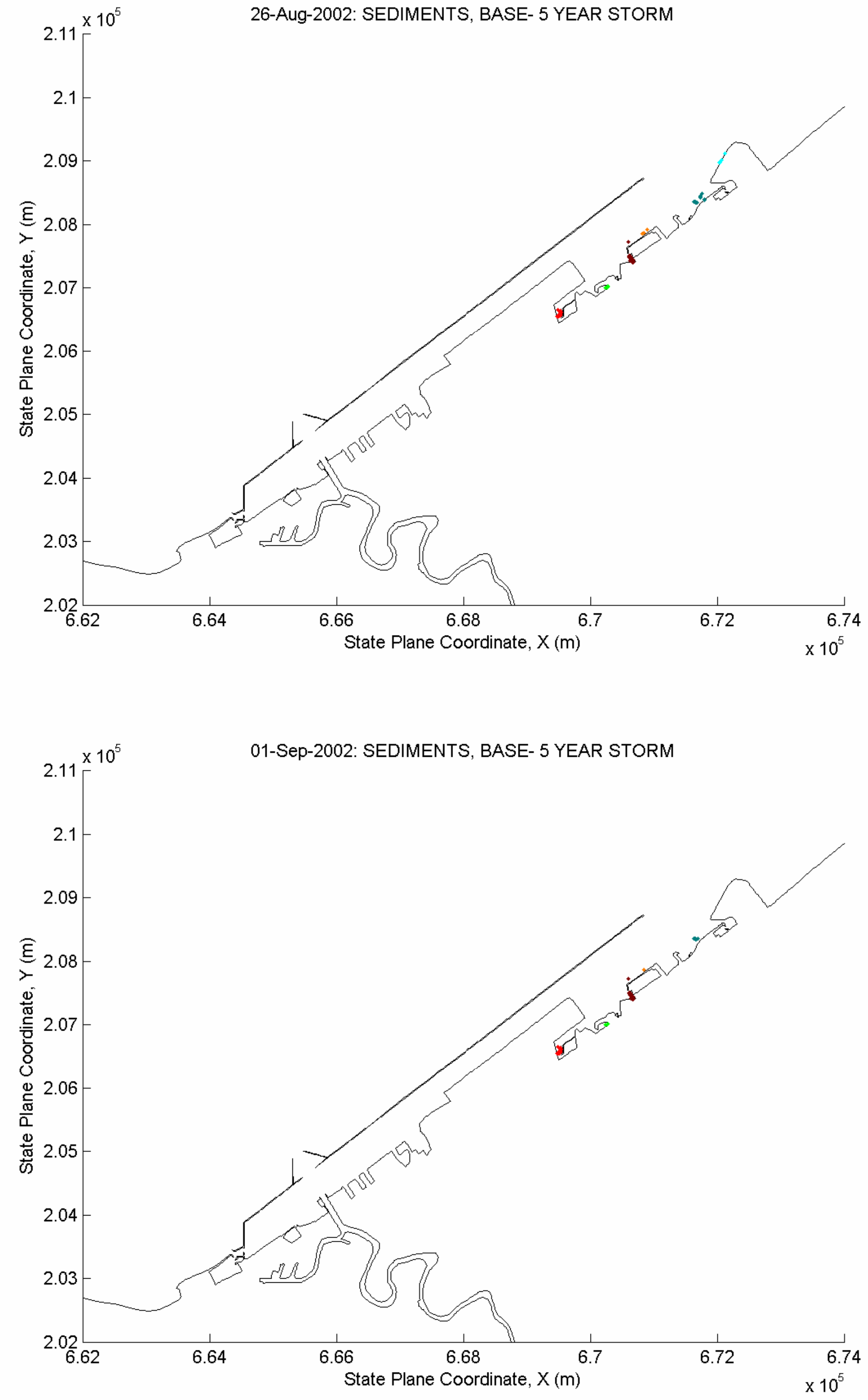


Figure 20 cont (c and d)

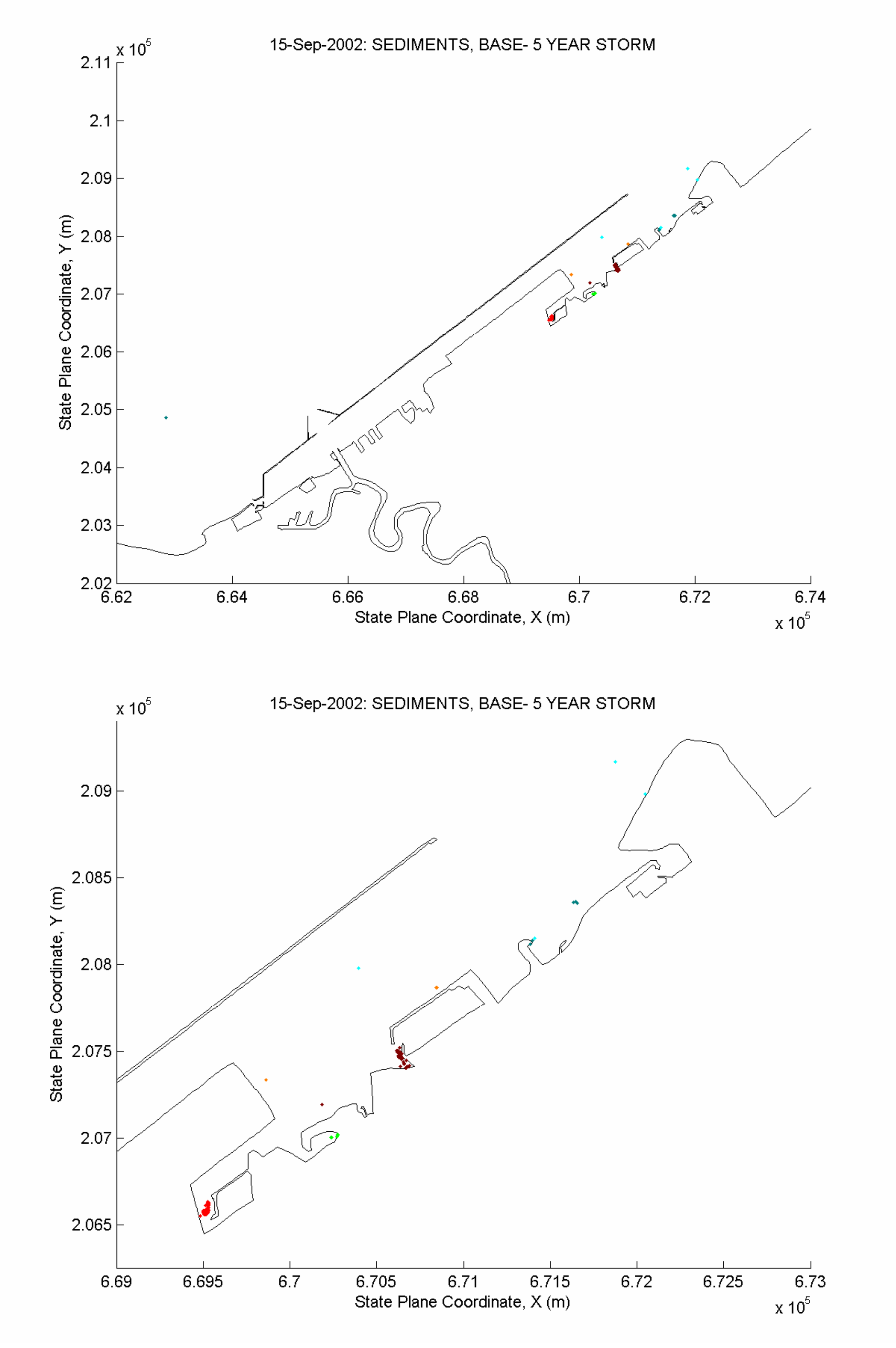


Figure 20. cont (e and f)

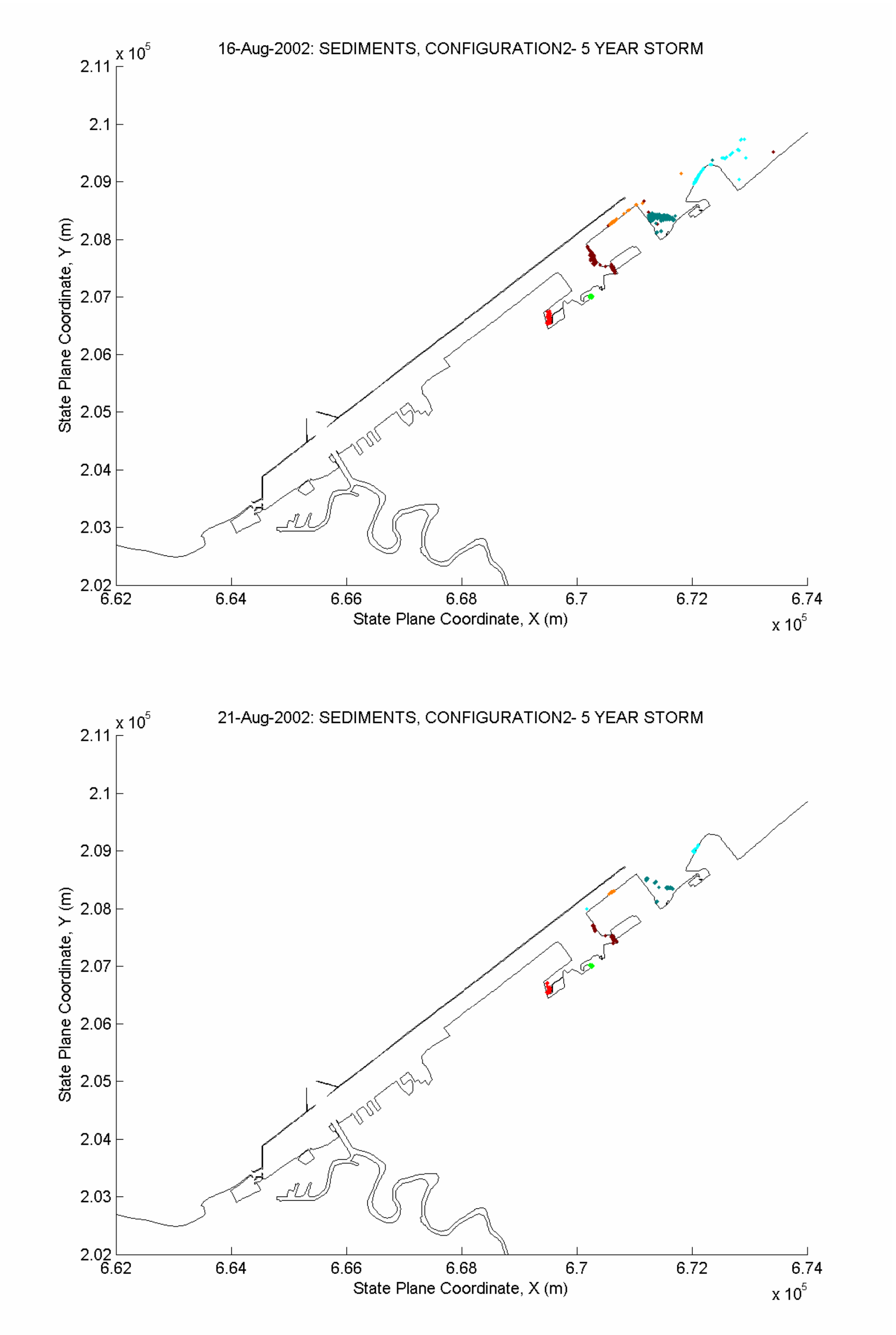


Figure 21. Sediment particle position with time from 5-year storm (particles colored to differentiate CSO) –Configuration 2 (a and b)

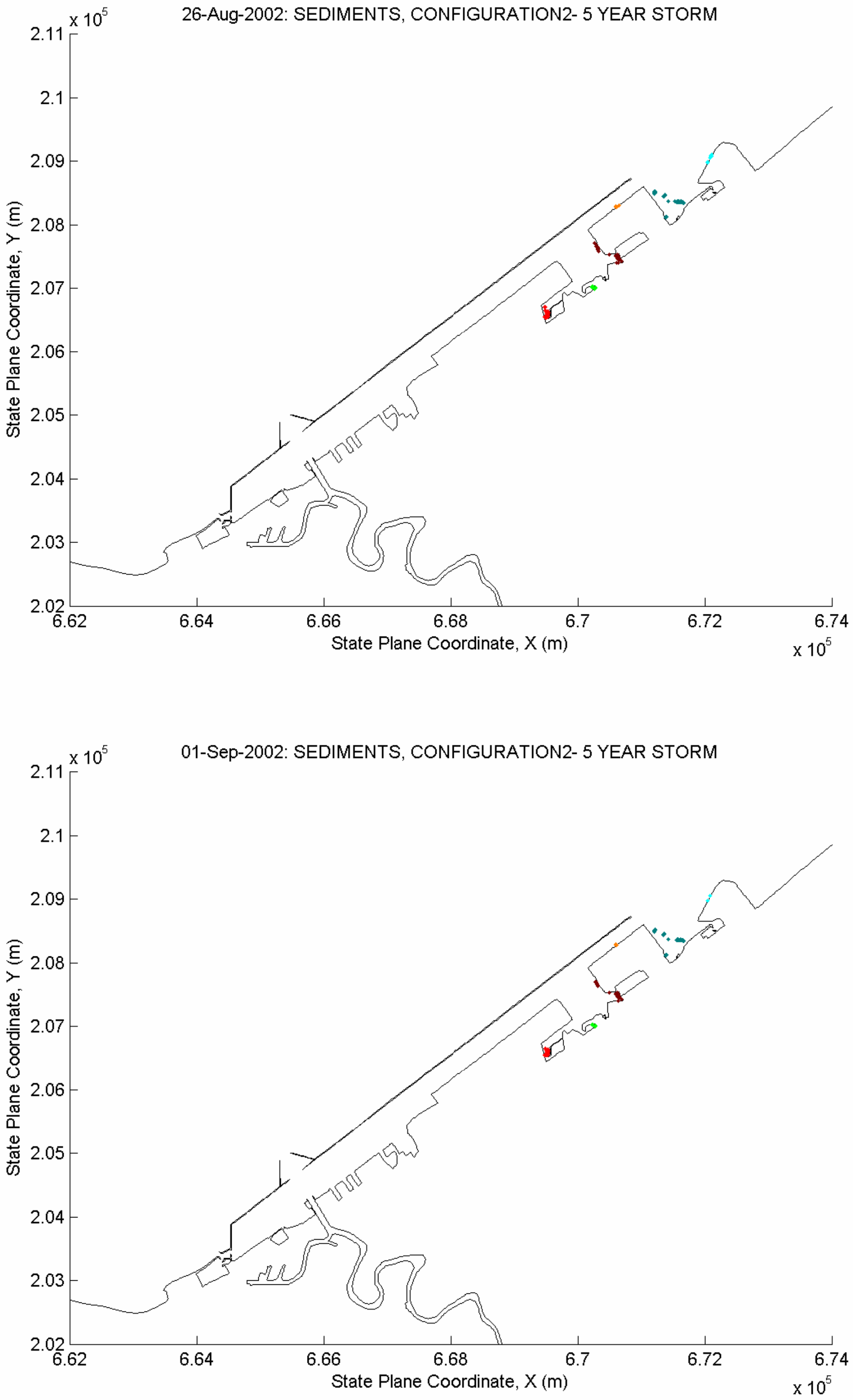
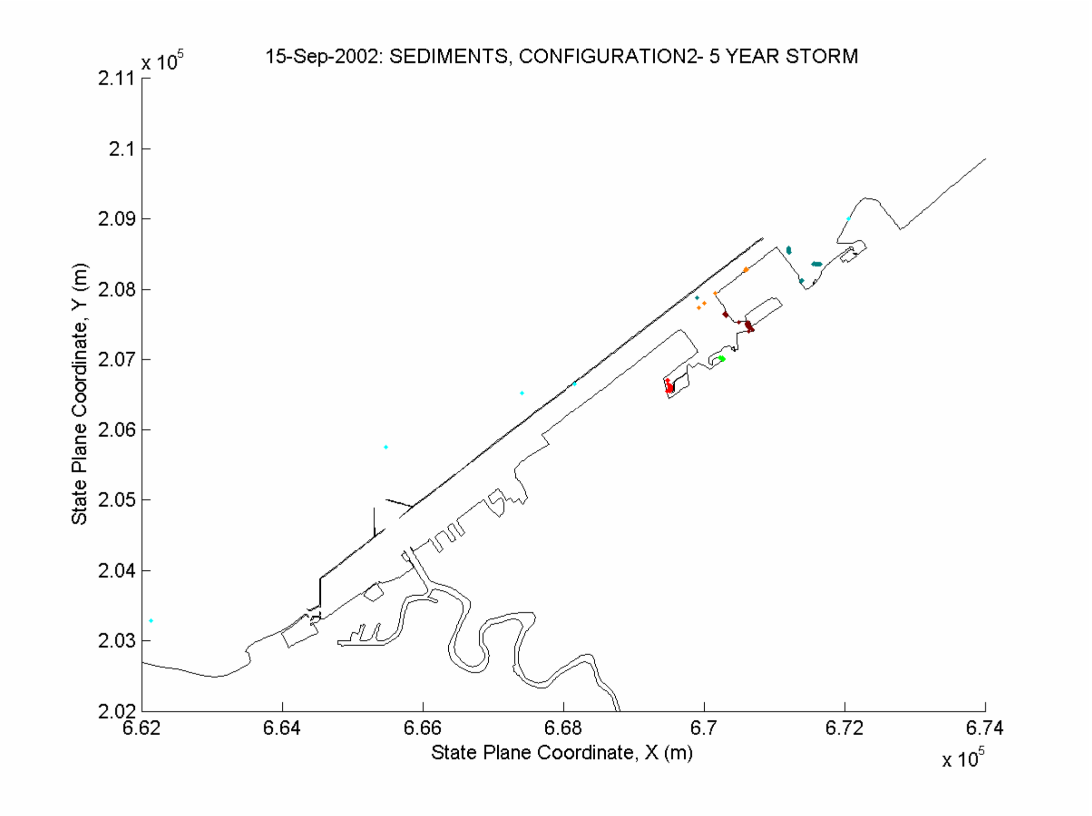


Figure 21. cont (c and d)



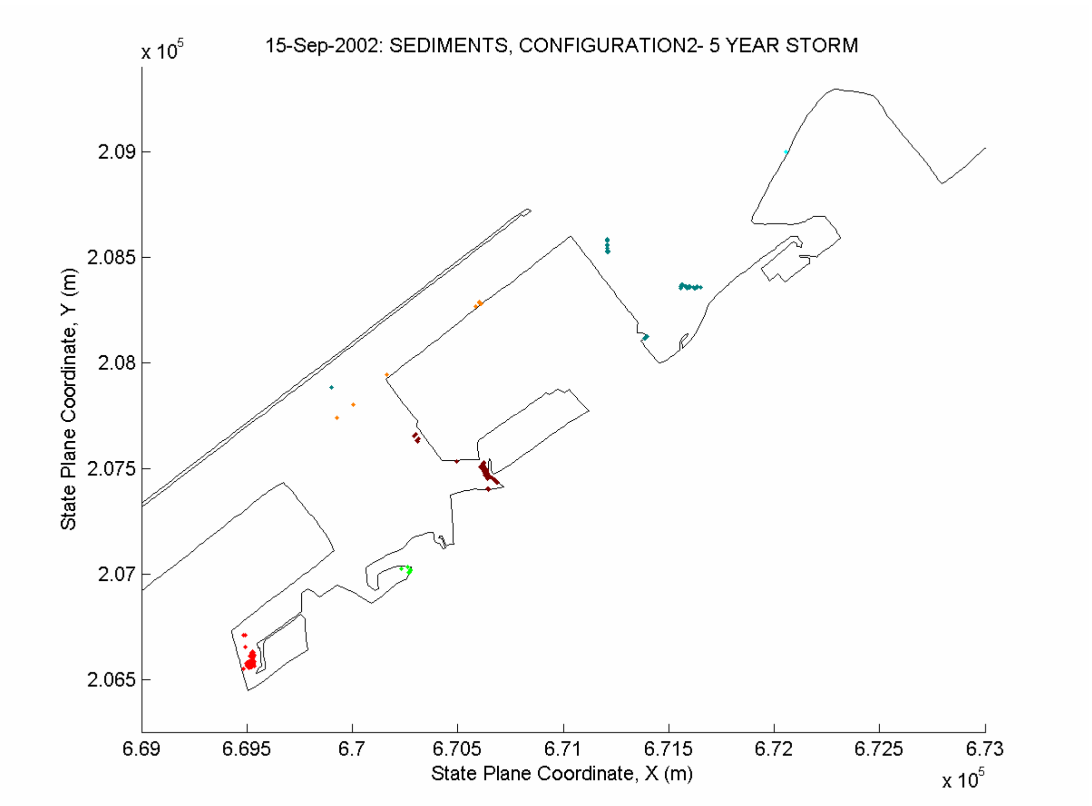


Figure 21. cont (e and f)

Concentration Analysis

Concentration analysis was performed using the calculated PTM simulation position results. Concentration values are reported in units of number of particles (FBC count) per volume of fluid. Figures 22 and 23 show the results of the base or existing configuration at several time steps for both the six month and five year month design storms respectively. As seen in the figures, initially there is a high concentration of particles close to the CSOs after all of the particles have been introduced into the flow for one day. Values above 5E7 particles per cubic meter were determined. The thin band of high concentration (red contours) quickly dissipates within a five day period. The band is broken into several smaller regions of highly concentrated particles as well as areas of smaller concentration due to advective mixing. Halfway through the simulation (September 1) most of the particles have dispersed, leaving primarily one region of high concentration near CSO 200. Particles (as mentioned previously) are trapped within this area. It should be noted, however, that for the purposes of these simulations, all calculations are conservative. Particles are not allowed to dissolve. It is probable that given time, the concentration in that region would decrease. Notable in these two simulations is the fact that the overall trend remains the same between the two design storms although the regions of higher concentration are slightly larger for the 5year storm.

Figures 24 and 25 show the concentration analysis results for configuration 2 for the sixth month and five year storms. The differences between these results and the previous results are obviously focused in the area of interest near the CDF. High levels of concentration develop near the east side of the proposed structure. However these areas quickly empty of particles and as can be seen in both figures, by 8/26 (10 days after all particles are introduced), the concentration is greatly reduced.

In Figures 26 and 27 concentration of sediment is shown for the base and configuration 2, 5 year design storm cases. These are primarily demonstrated as representative examples of sediment concentration in general. In this case concentration is a non-dimensional value. Because the original percentage of sediment to CSO discharge was unknown and therefore described as a proportion, the sediment concentration was non-dimensionalized. The real sediment concentration C_s is

$$C_s = N * 10C_0 (kg/m^3)$$

where N is the dimensionless sediment concentration seen in the figure and C_0 is the sediment mass rate discharged from the CSO.

Similar to the previous figures in the sediment section of the particle transport it can be seen that the sediment concentrations appear to be much less diffused. Because of the process of settling and resuspension, much of the transport occurs through interaction with the bed and therefore isn't seen in the concentration values which only account for those particles that are in the water column. In addition, condensed regions of sediment remain trapped in areas of recirculating flow. Here sediment may be resuspended but then quickly deposit. There is no overall transport out of the trapped areas, so it appears as if sediment remains in the water column indefinitely.

Background levels of particulate concentration were not taken into account within these simulations. Therefore all concentration levels should be considered as additive values above the existing background level in the area.

Conclusions and Remaining Work

To address the issue of the CSO constituent fate in Cleveland Harbor and the effect of the construction of a CDF in the area, the Particle Tracking Model (PTM) was applied to four phases of construction. Neutrally buoyant particles as well as floatables were modeled to represent chemical transport and debris transport respectively. Particle path determination and concentration mapping were performed. It was established that generally most neutrally buoyant particles were transported out of the system within a thirty day period, except for two "hot spots" where particles were trapped by the contained flow areas. Concentration values quickly dissipated as a result of the particle transport, following the same trend. Floatable particles rapidly exited the system due to the additional factor of wind forcing.

Further work will be performed to determine the effect of nearbed sediment transport (particle density > water density) utilizing GTRAN which can better predict nearbed sediment pathways. Due to the lack of data regarding the sediment quantities, a method was devised to estimate sediment proportional values to discharge. Results were shown based on these proportional values. It is recommended that data be collected regarding the actual percentages of sediment within CSO discharges. In addition it is recommended that eventually the effect of the non-conservative aspects of chemical particle transports is considered.

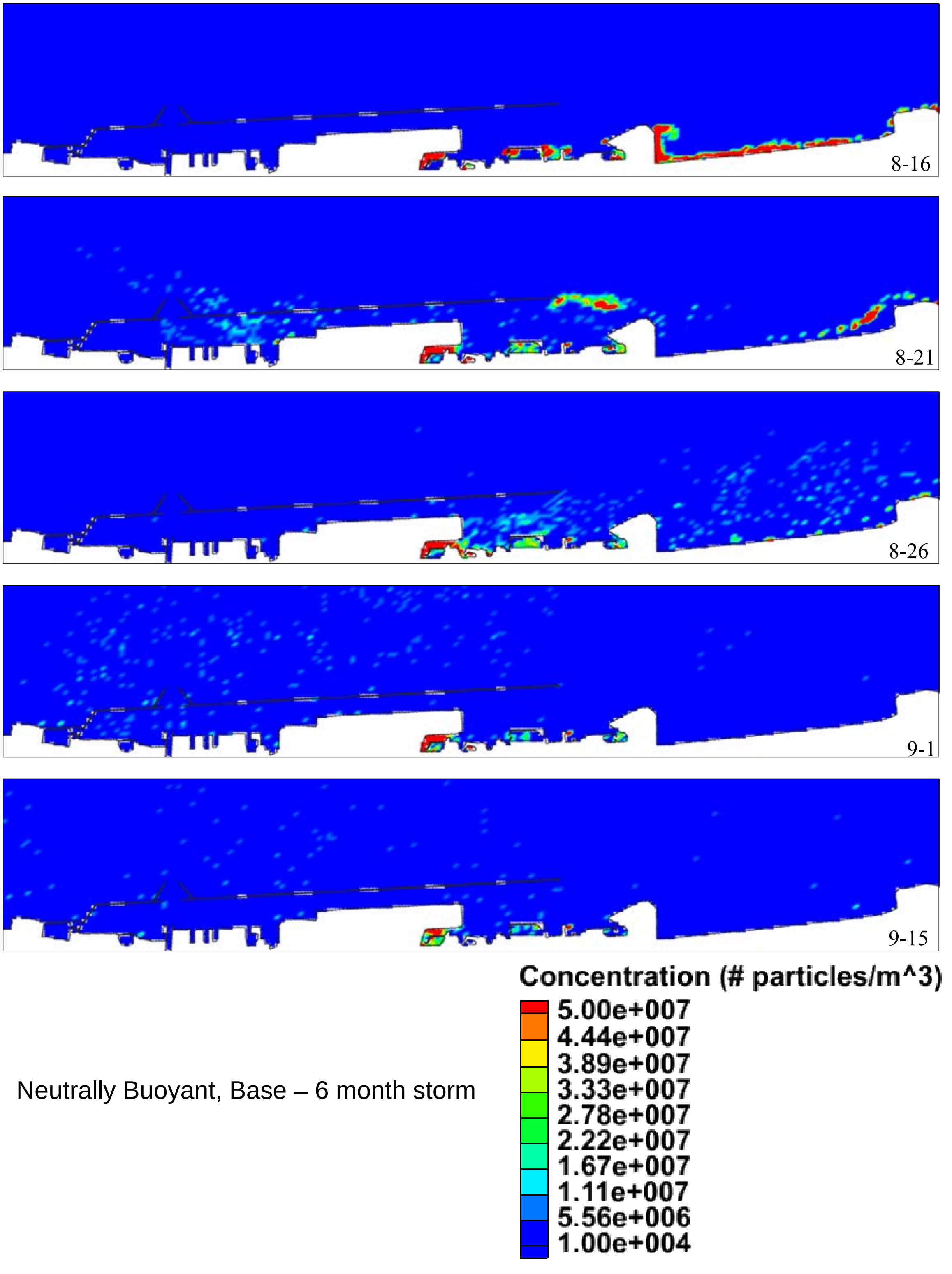


Figure 22. Concentration (particles per volume) values at 00:00 for 6month storm, base configuration.

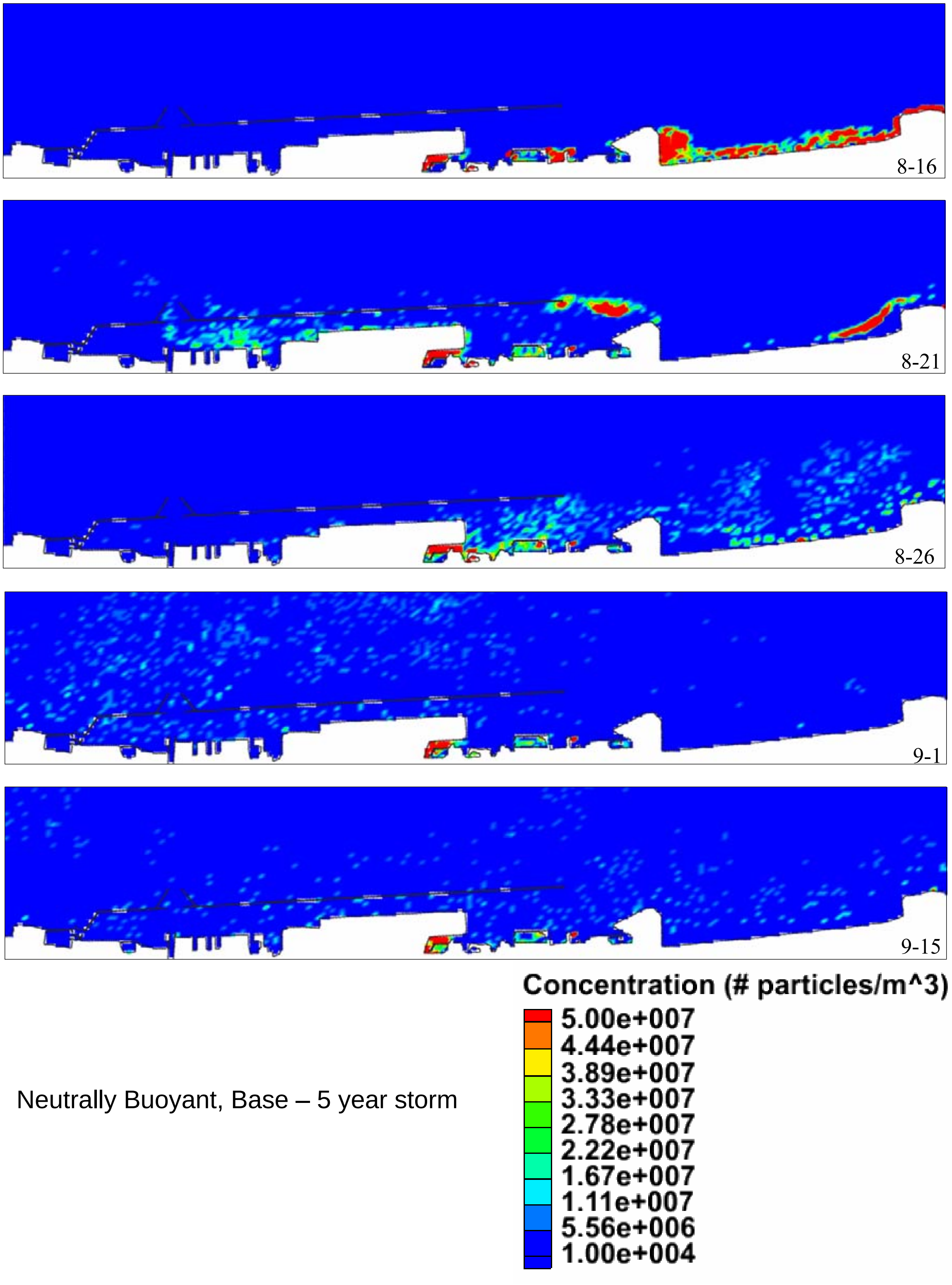
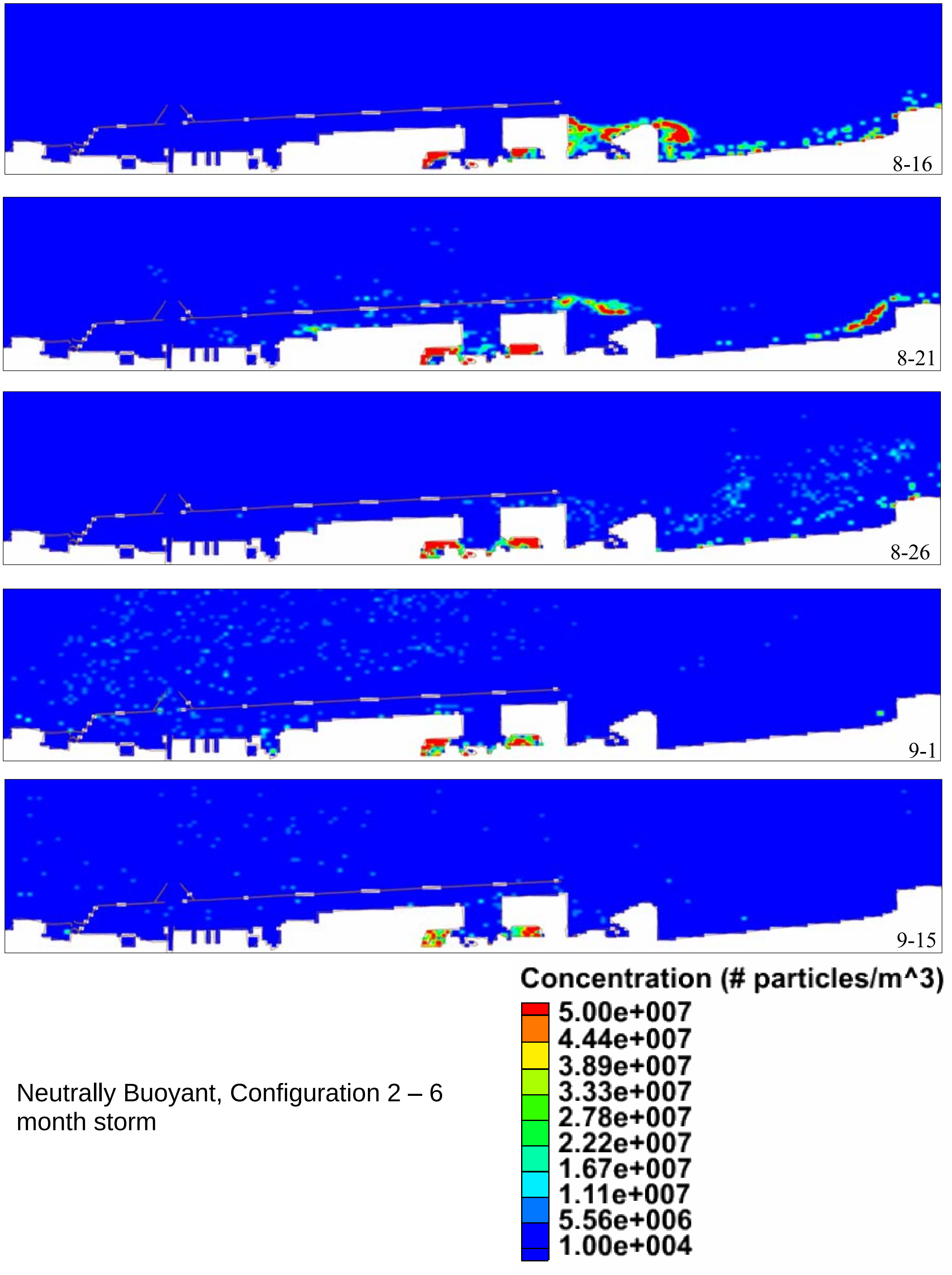


Figure23. Concentration (particles per volume) values at 00:00 for 5 year storm, base configuration.



Neutrally Buoyant, Configuration 2 – 6 month storm

Figure24. Concentration (particles per volume) values at 00:00 for 6month storm, Configuration 2.

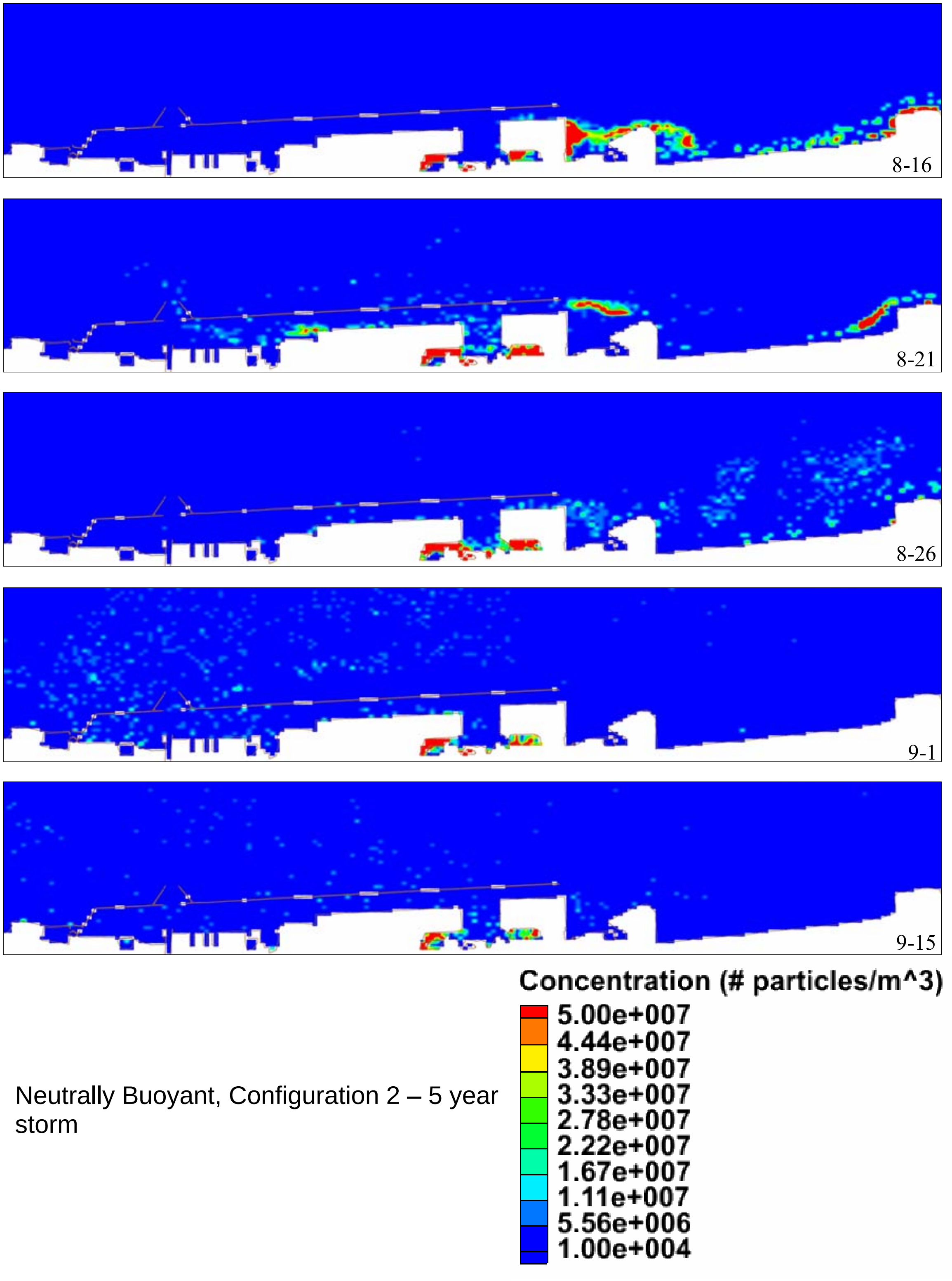


Figure25. Concentration (particles per volume) values at 00:00 for 5 year storm, Configuration 2.

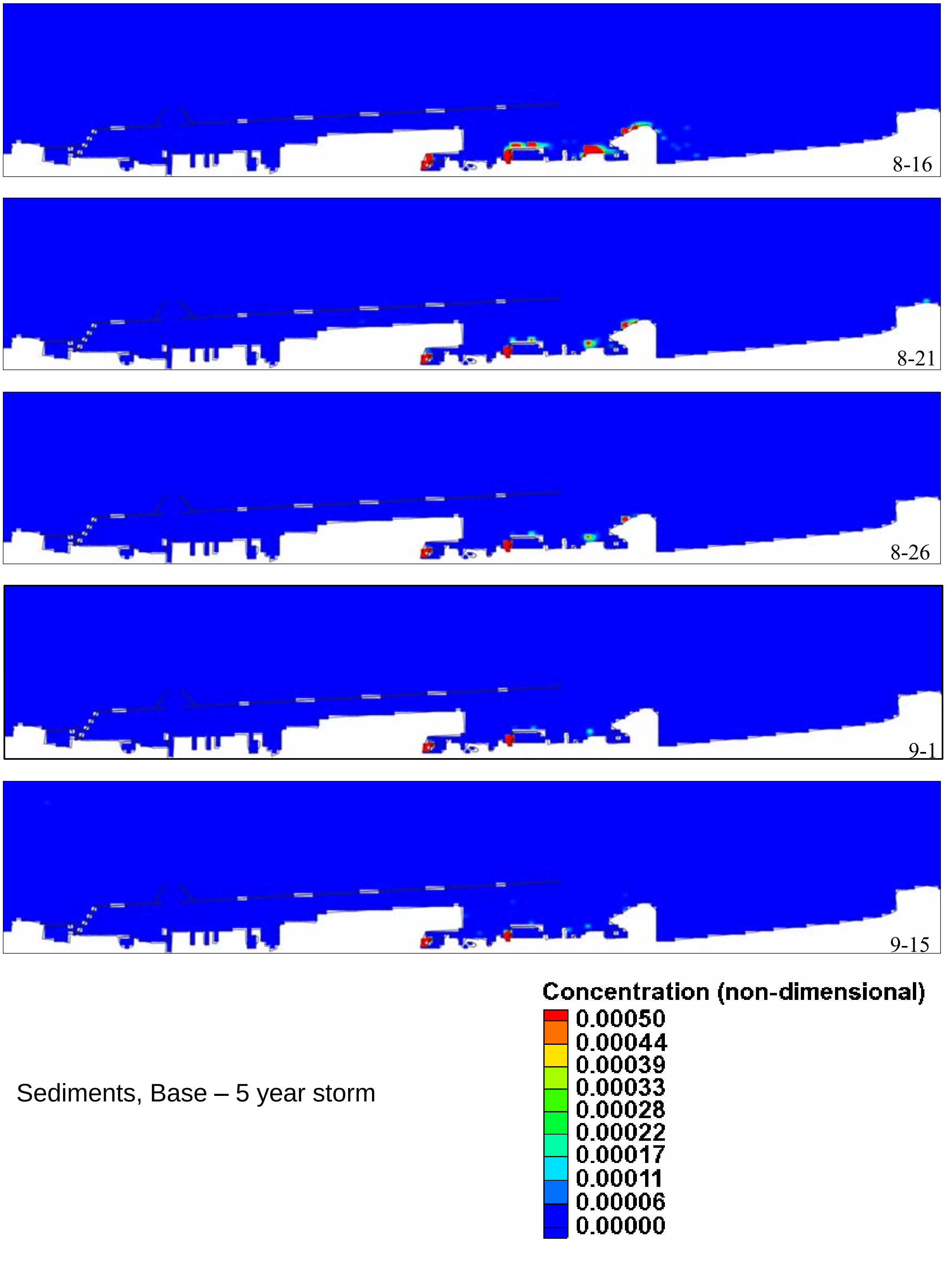


Figure26. Concentration (particles per volume) values at 00:00 for 5 year storm, Configuration 2.

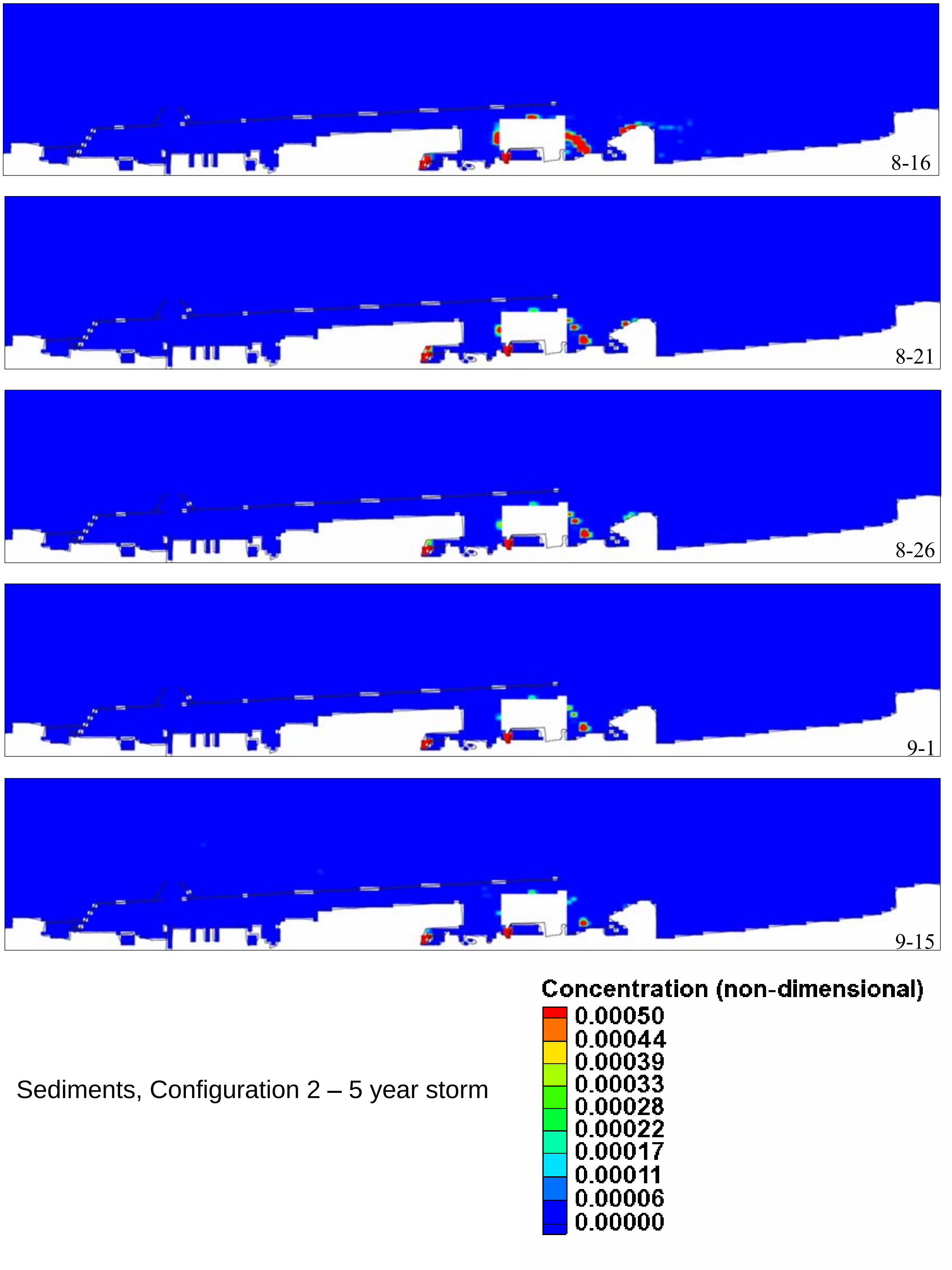


Figure27. Concentration (particles per volume) values at 00:00 for 5 year storm, Configuration 2.

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Appendix A

6-month Design Storm													
Time	Rainfall	CSO 200		CSO 201		CSO 202		CSO 203		CSO 204		CSO 205	
Hours	Inches	Discharge CMS	Fecal Coliform #/sec	Discharge CMS	Fecal Coliform #/sec	Discharge CMS	Fecal Coliform #/sec	Discharge CMS	Fecal Coliform #/sec	Discharge CMS	Fecal Coliform #/sec	Discharge CMS	Fecal Coliform #/sec
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.25	0.0025	0	0	0	0	0	0	0	0	0	0	0	0
0.5	0.0025	0	0	0	0	0	0	0	0	0	0	0	0
0.75	0.0025	0	0	0	0	0	0	0	0	0	0	0	0
1	0.0025	0	0	0	0	0	0	0	0	0	0	0	0
1.25	0.015	0	0	0	0	0	0	0	0	0	0	0	0
1.5	0.015	0	0	0	0	0	0	0	0	0	0	0	0
1.75	0.015	0	0	0	0	0	0	0	0	0	0	0	0
2	0.015	0	0	0	0	0	0	0	0	0	0	0	0
2.25	0.005	0	0	0	0	0	0	0	0	0	0	0	0
2.5	0.005	0	0	0	0	0	0	0	0	0	0	0	0
2.75	0.005	0.02	5.74E+07	0	0	0	0	0	0	0	0	0	0
3	0.005	0.03	8.01E+07	0	0	0	0	0	0	0	0	0	0
3.25	0.1825	0.03	8.35E+07	0	0	0	0	0	0	0	0	0	0
3.5	0.1825	0.29	7.53E+08	0.10	2.60E+08	0.09	2.27E+08	0	0	0.13	3.43E+08	0.15	3.81E+08
3.75	0.1825	2.22	5.80E+09	0.85	2.22E+09	3.51	9.15E+09	0.41	1.08E+09	1.13	2.96E+09	1.45	3.79E+09
4	0.1825	4.10	1.07E+10	1.24	3.23E+09	6.95	1.81E+10	0.98	2.56E+09	3.72	9.71E+09	1.98	5.17E+09
4.25	0.065	4.87	1.27E+10	1.45	3.80E+09	8.24	2.15E+10	1.44	3.77E+09	7.67	2.00E+10	2.10	5.47E+09
4.5	0.065	4.43	1.16E+10	0.90	2.36E+09	7.38	1.93E+10	1.26	3.30E+09	8.07	2.11E+10	1.58	4.13E+09
4.75	0.065	3.12	8.14E+09	0.54	1.41E+09	4.91	1.28E+10	0.68	1.78E+09	6.98	1.82E+10	0.98	2.55E+09
5	0.065	2.44	6.36E+09	0.39	1.03E+09	3.63	9.46E+09	0.45	1.17E+09	5.30	1.38E+10	0.77	2.00E+09

5.25	0.005	2.19	5.70E+09	0.33	8.67E+08	3.07	8.03E+09	0.34	8.91E+08	4.02	1.05E+10	0.71	1.84E+09
5.5	0.005	1.84	4.79E+09	0.21	5.55E+08	2.41	6.30E+09	0.17	4.43E+08	3.07	8.01E+09	0.51	1.34E+09
5.75	0.005	1.19	3.11E+09	0.07	1.78E+08	1.30	3.39E+09	0	0	2.28	5.96E+09	0.25	6.50E+08
6	0.005	0.72	1.89E+09	0	0	0.42	1.11E+09	0	0	1.49	3.88E+09	0.09	2.44E+08
6.25	0	0.45	1.19E+09	0	0	0.02	4.96E+07	0	0	0.79	2.05E+09	0.02	4.96E+07
6.5	0	0.29	7.57E+08	0	0	0	0	0	0	0.29	7.59E+08	0	0
6.75	0	0.18	4.75E+08	0	0	0	0	0	0	0.03	8.30E+07	0	0
7	0	0.11	2.82E+08	0	0	0	0	0	0	0	0	0	0
7.25	0	0	0	0	0	0	0	0	0	0	0	0	0

5-Year Design Storm													
Time	Rainfall	CSO 200		CSO 201		CSO 202		CSO 203		CSO 204		CSO 205	
Hours	Inches	Discharge CMS	Fecal Coliform #/sec	Discharge CMS	Fecal Coliform #/sec	Discharge CMS	Fecal Coliform #/sec	Discharge CMS	Fecal Coliform #/sec	Discharge CMS	Fecal Coliform #/sec	Discharge CMS	Fecal Coliform #/sec
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.25	0.015	0	0	0	0	0	0	0	0	0	0	0	0
0.5	0.015	0	0	0	0	0	0	0	0	0	0	0	0
0.75	0.015	0	0	0	0	0	0	0	0	0	0	0	0
1	0.015	0	0	0	0	0	0	0	0	0	0	0	0
1.25	0.025	0	0	0	0	0	0	0	0	0	0	0	0
1.5	0.025	0	0	0	0	0	0	0	0	0	0	0	0
1.75	0.025	0	0	0	0	0	0	0	0	0	0	0	0
2	0.025	0	0	0	0	0	0	0	0	0	0	0	0
2.25	0.0575	0	0	0	0	0	0	0	0	0	0	0	0
2.5	0.0575	0	0	0	0	0	0	0	0	0	0	0	0
2.75	0.0575	0.04	1.12E+08	0	0	0	0	0	0	0	0	0	0
3	0.0575	0.06	1.56E+08	0	0	0	0	0	0	0	0	0	0
3.25	0.3575	0.06	1.62E+08	0	0	0	0	0	0	0	0	0	0
3.5	0.3575	0.56	1.47E+09	0.19	5.05E+08	0.17	4.41E+08	0	0	0.26	6.67E+08	0.28	7.41E+08
3.75	0.3575	4.32	1.13E+10	1.66	4.32E+09	6.82	1.78E+10	0.81	2.11E+09	2.21	5.76E+09	2.82	7.37E+09
4	0.3575	7.98	2.08E+10	2.41	6.28E+09	13.52	3.53E+10	1.91	4.99E+09	7.24	1.89E+10	3.86	1.01E+10
4.25	0.05	9.47	2.47E+10	2.83	7.39E+09	16.03	4.18E+10	2.81	7.33E+09	14.92	3.89E+10	4.08	1.06E+10
4.5	0.05	8.63	2.25E+10	1.76	4.58E+09	14.35	3.75E+10	2.46	6.42E+09	15.71	4.10E+10	3.08	8.03E+09
4.75	0.05	6.07	1.58E+10	1.05	2.73E+09	9.55	2.49E+10	1.33	3.47E+09	13.58	3.54E+10	1.90	4.97E+09
5	0.05	4.74	1.24E+10	0.77	2.00E+09	7.05	1.84E+10	0.87	2.28E+09	10.32	2.69E+10	1.49	3.89E+09

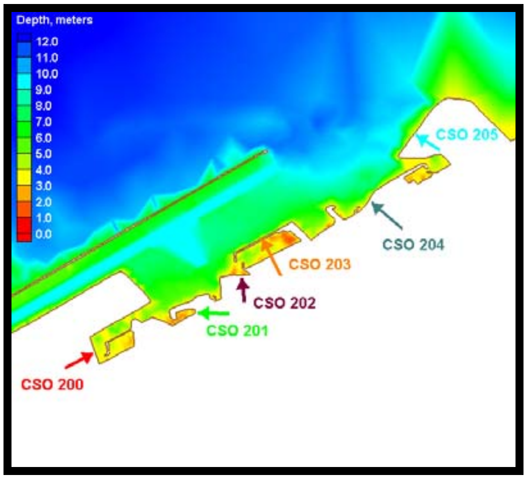
5.25	0.03	4.25	1.11E+10	0.65	1.69E+09	5.98	1.56E+10	0.66	1.73E+09	7.82	2.04E+10	1.37	3.58E+09
5.5	0.03	3.57	9.32E+09	0.41	1.08E+09	4.69	1.22E+10	0.33	8.63E+08	5.97	1.56E+10	1.00	2.61E+09
5.75	0.03	2.32	6.05E+09	0.13	3.47E+08	2.53	6.59E+09	0	0	4.44	1.16E+10	0.48	1.26E+09
6	0.03	1.41	3.67E+09	0	0	0.83	2.16E+09	0	0	2.90	7.56E+09	0.18	4.74E+08
6.25	0	0.88	2.31E+09	0	0	0.04	9.65E+07	0	0	1.53	3.99E+09	0.04	9.65E+07
6.5	0	0.56	1.47E+09	0	0	0	0	0	0	0.57	1.48E+09	0	0
6.75	0	0.35	9.24E+08	0	0	0	0	0	0	0.06	1.61E+08	0	0
7	0	0.21	5.48E+08	0	0	0	0	0	0	0	0	0	0
7.25	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix B: Particle Positions

- Particle Type
  - Neutrally Buoyant
  - Floatables
  - Sediment

- Geometry
  - Base
  - Configuration 1
  - Configuration 2
  - Configuration 3

- Hydrodynamics
  - 6 month storms
  - 5 year storms



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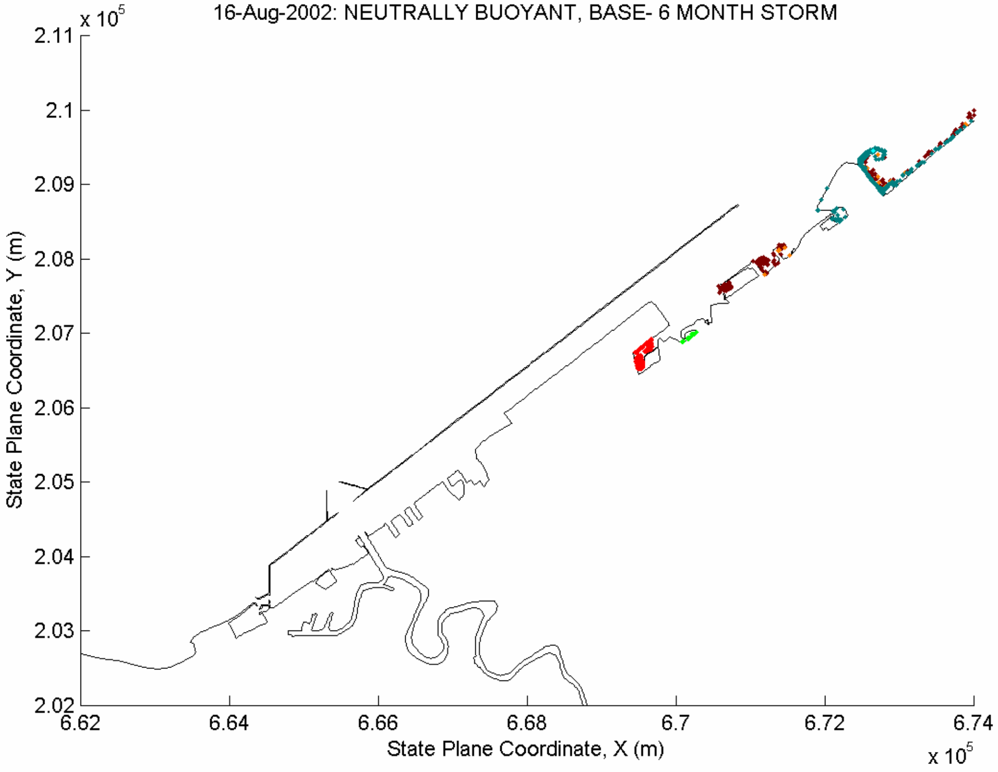
The figures are arranged by particle type, geometry and hydrodynamics. There are three particle types used, neutrally buoyant, floatables, and sediment. There are four different geometry types that are used and they are the base condition, configuration 1, configuration 2, and configuration 3. The hydrodynamics was used for 6 month and 5 years storms. Each particle type has a geometry and hydrodynamics representation.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State Plane Coordinate, Y (m)
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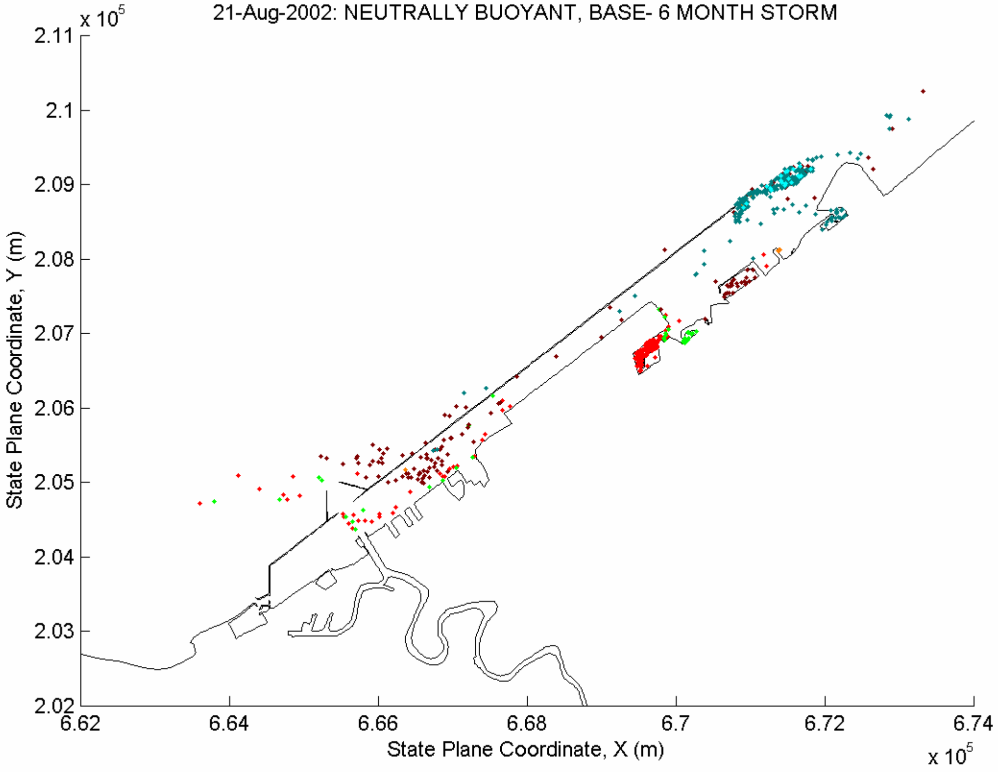
State Plane Coordinate, X (m)
x 10^5


21-Aug-2002: NEUTRALLY BUOYANT, BASE- 6 MONTH STORM
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State Plane Coordinate, Y (m)
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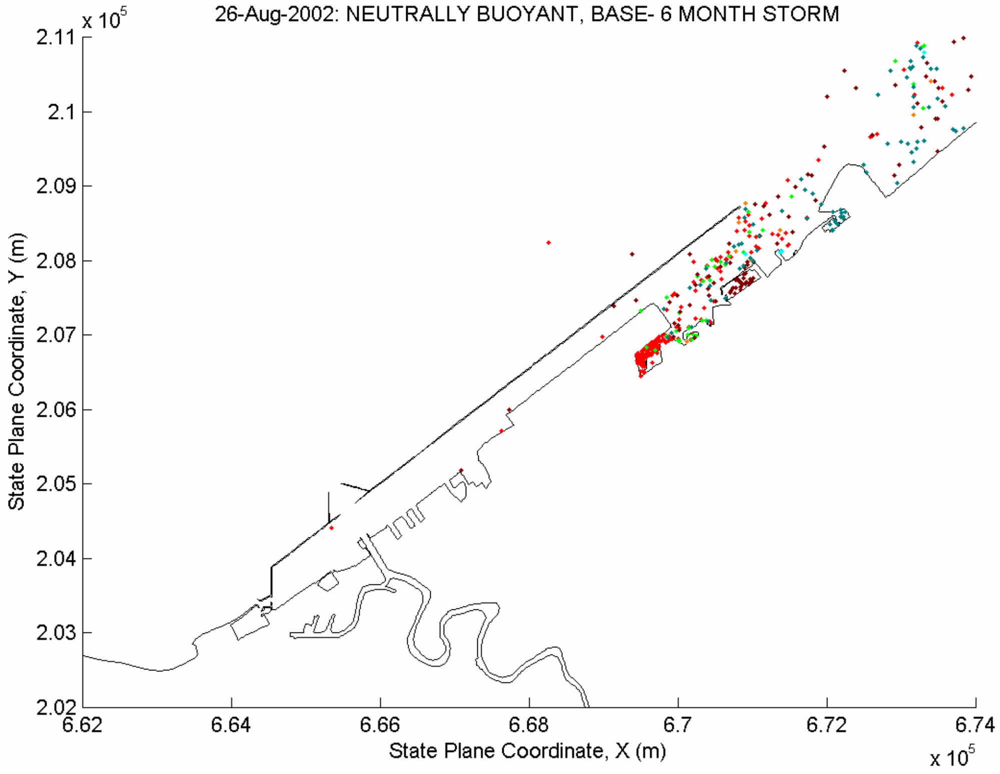
State Plane Coordinate, X (m)
x 10^5


26-Aug-2002: NEUTRALLY BUOYANT, BASE- 6 MONTH STORM
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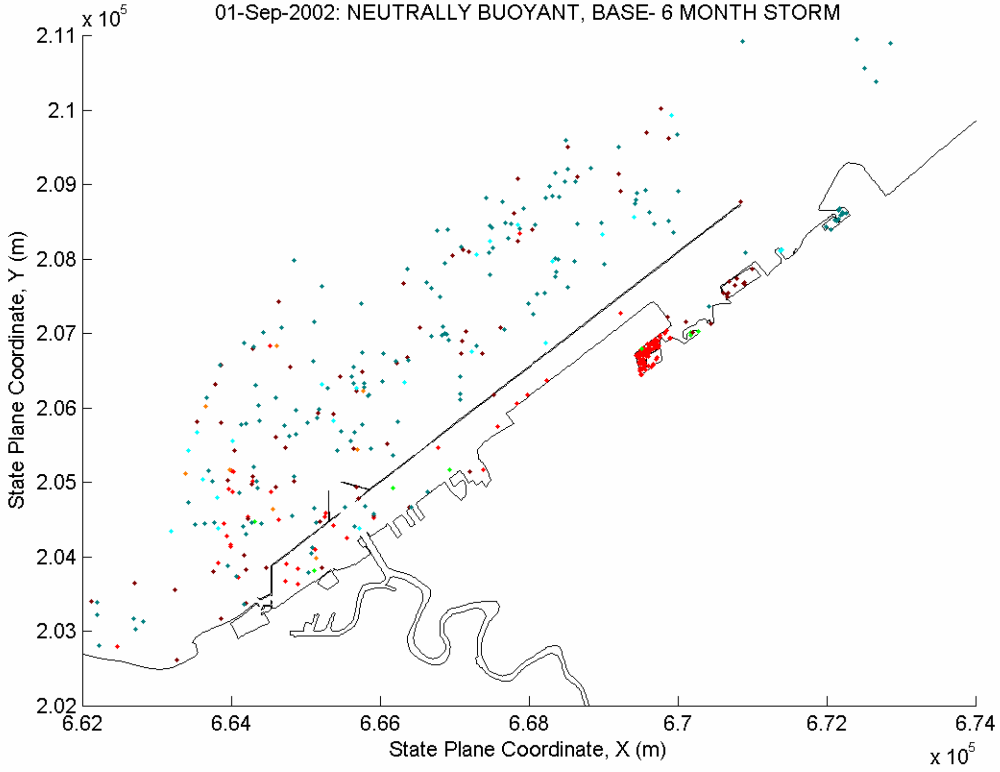
State Plane Coordinate, X (m)
x 10^5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State Plane Coordinate, Y (m)
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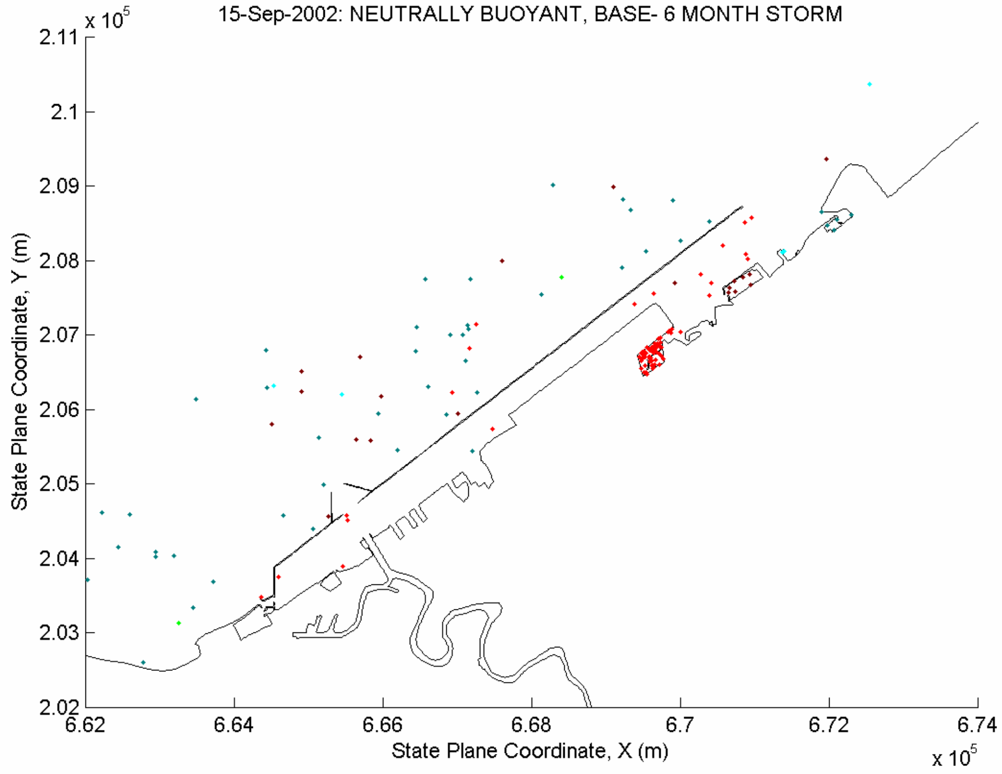
State Plane Coordinate, X (m)
x 10^5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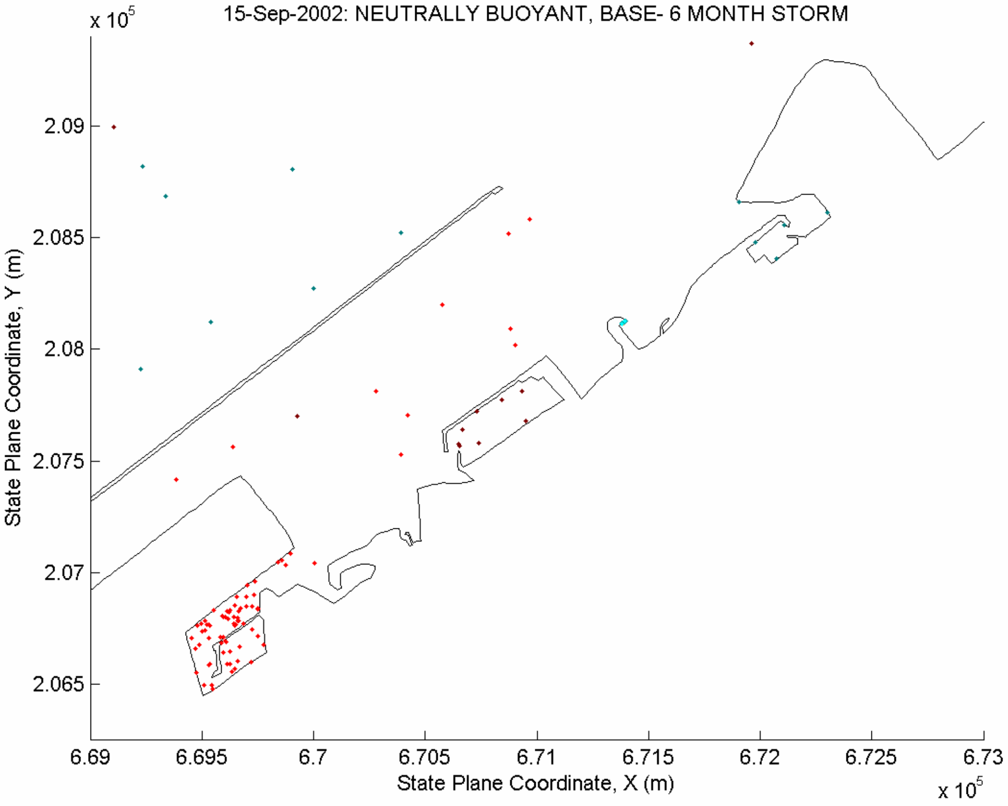
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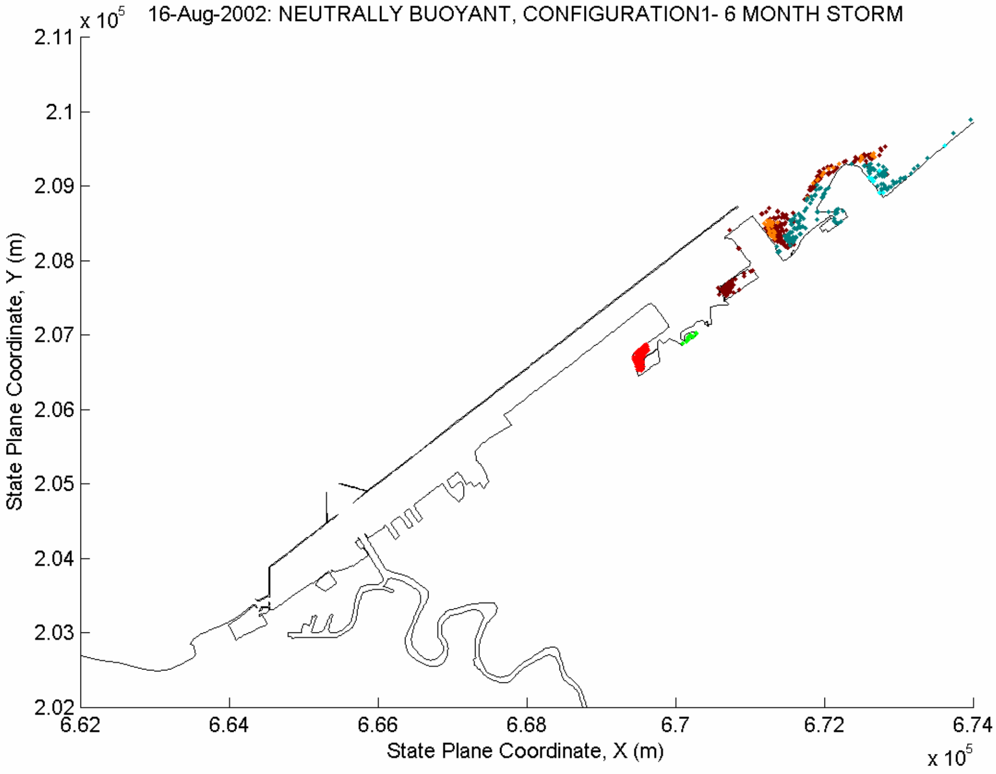
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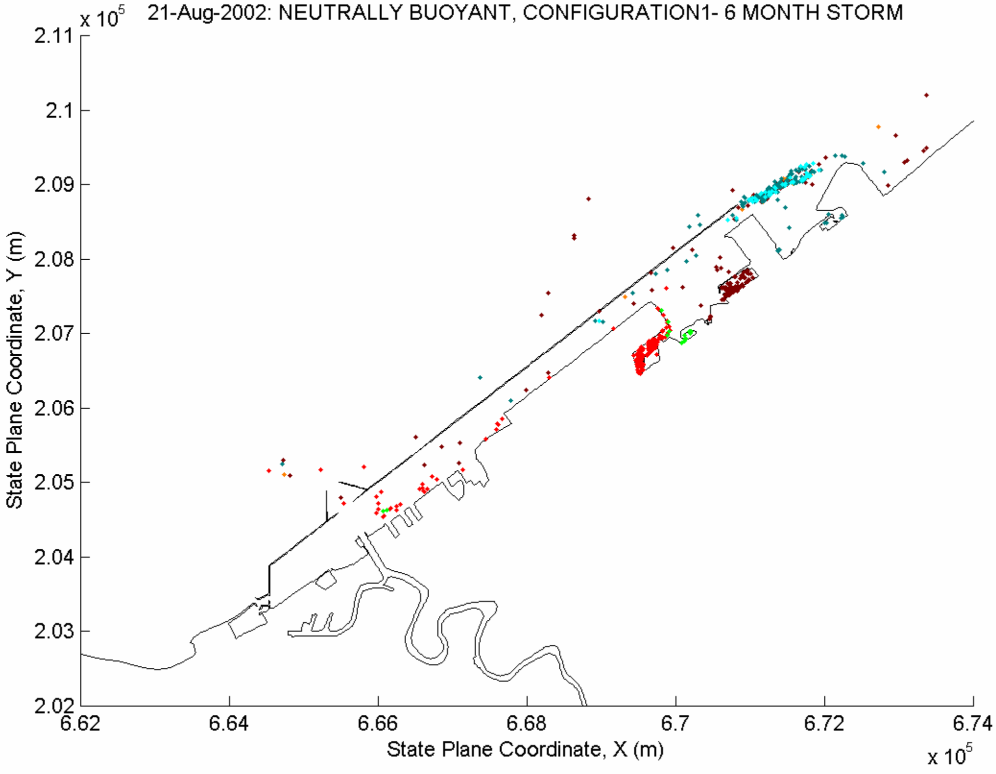
State Plane Coordinate, X (m)
x 10^5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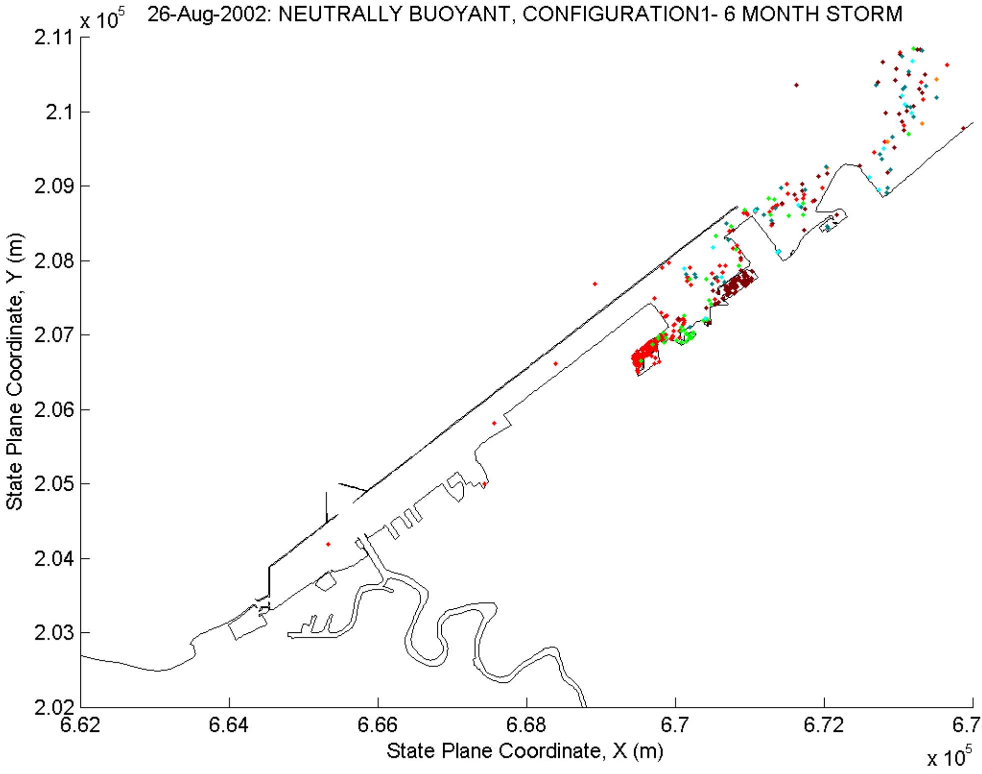
x 10^5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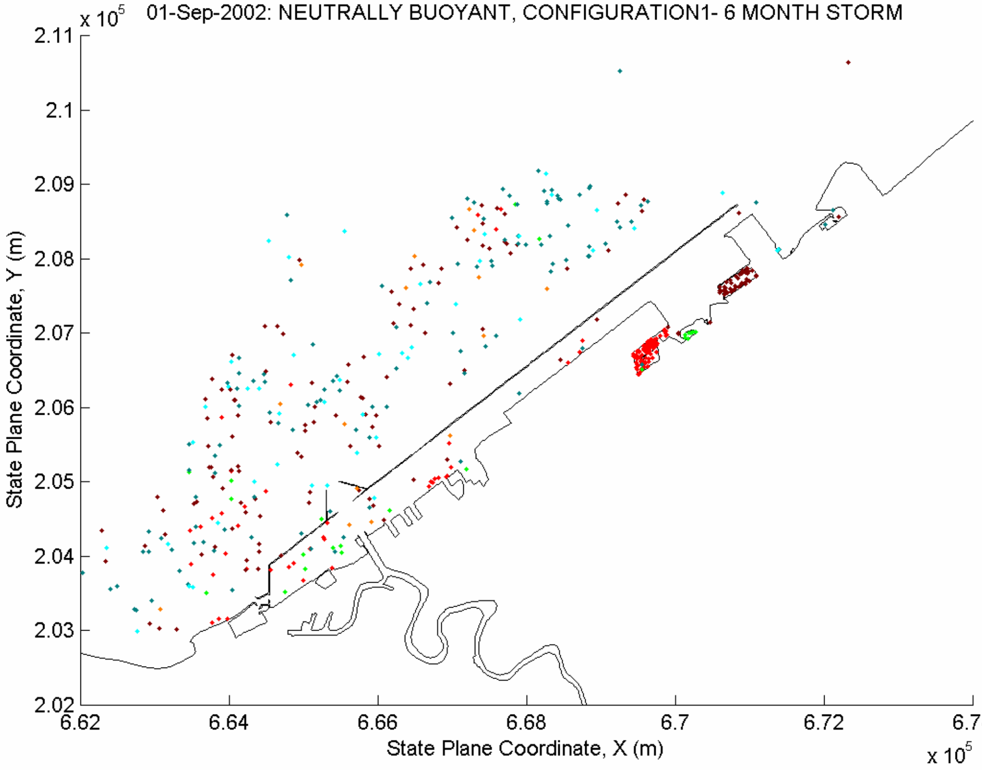
State Plane Coordinate, X (m)
x 10^5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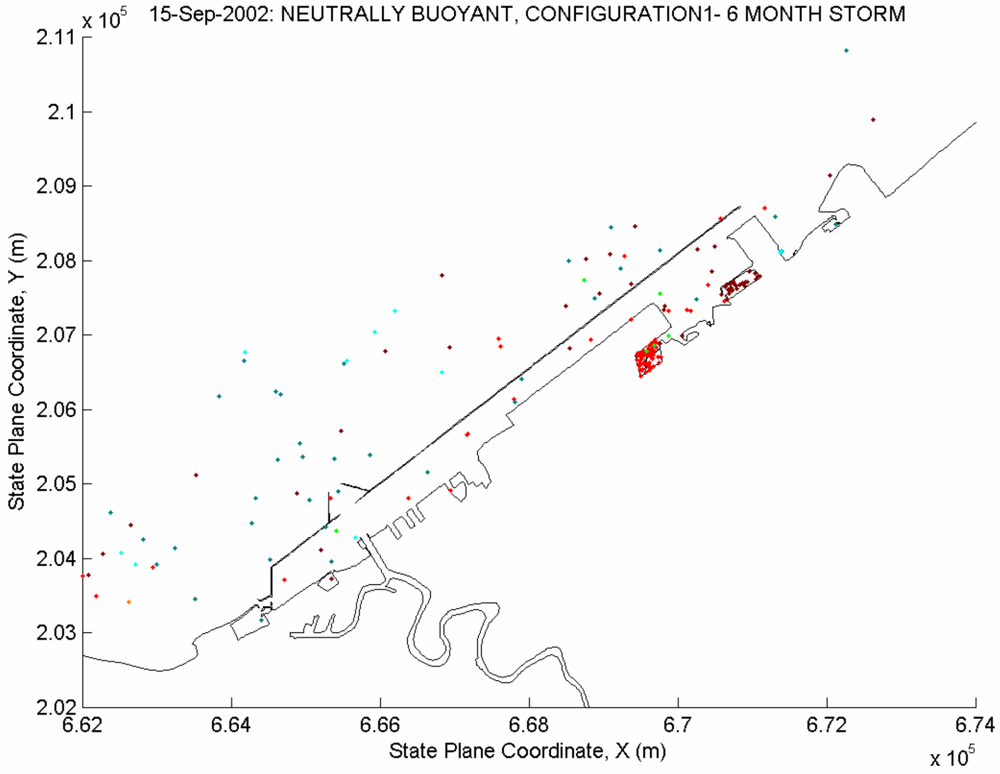
State Plane Coordinate, X (m)
x 10^5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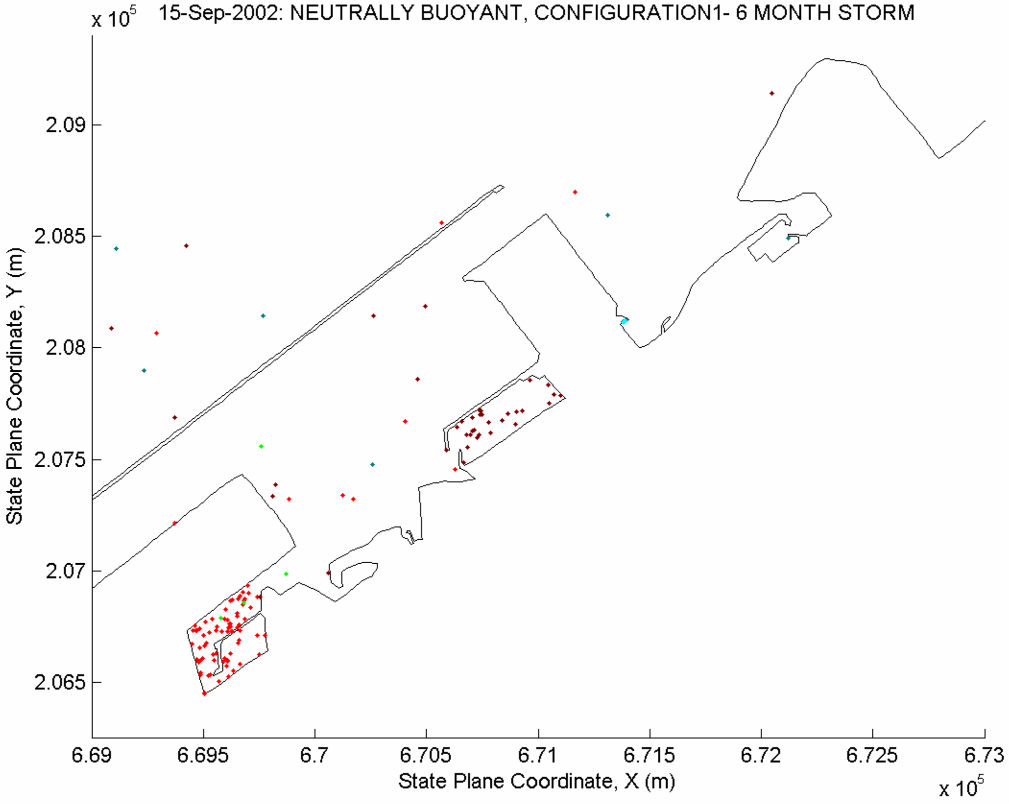
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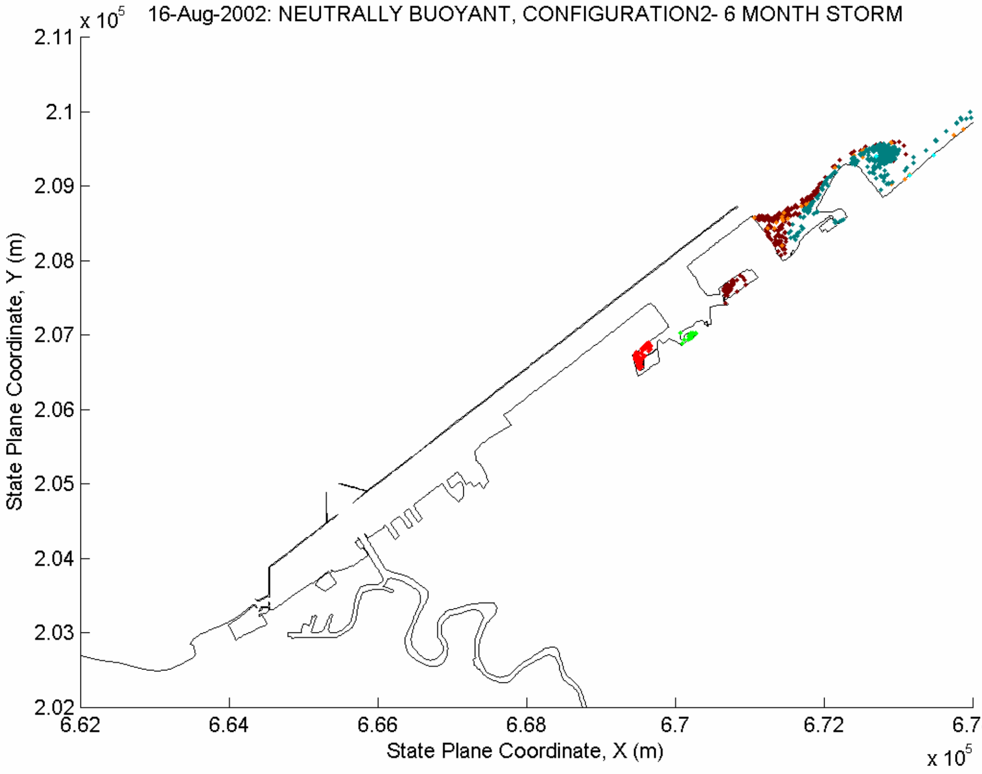
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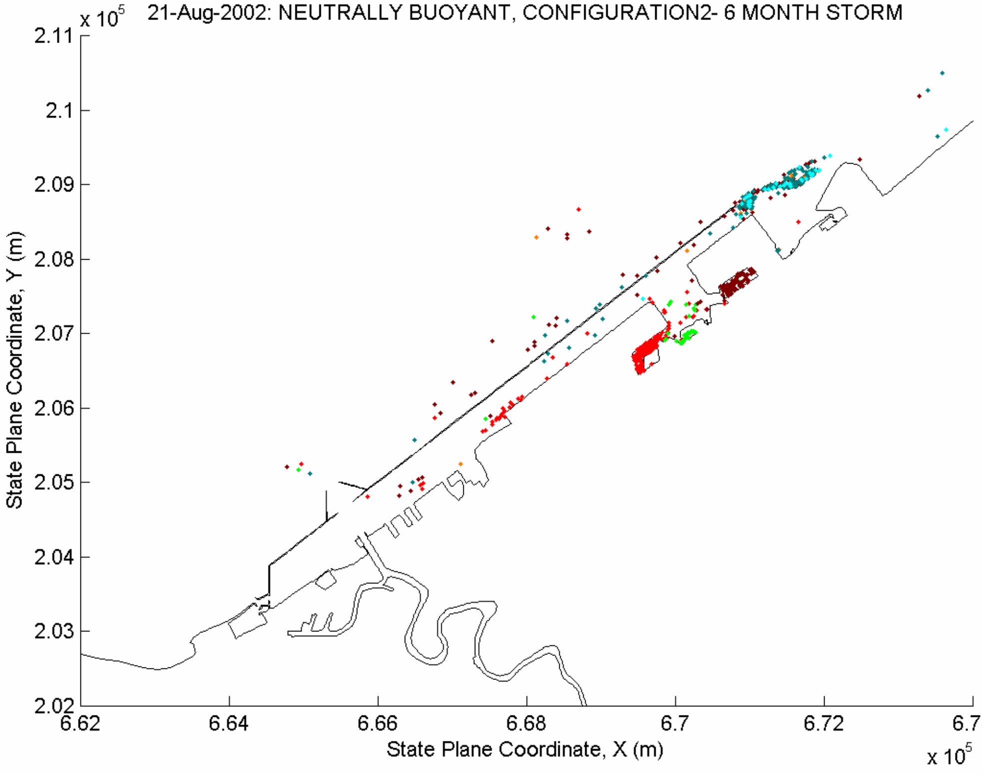
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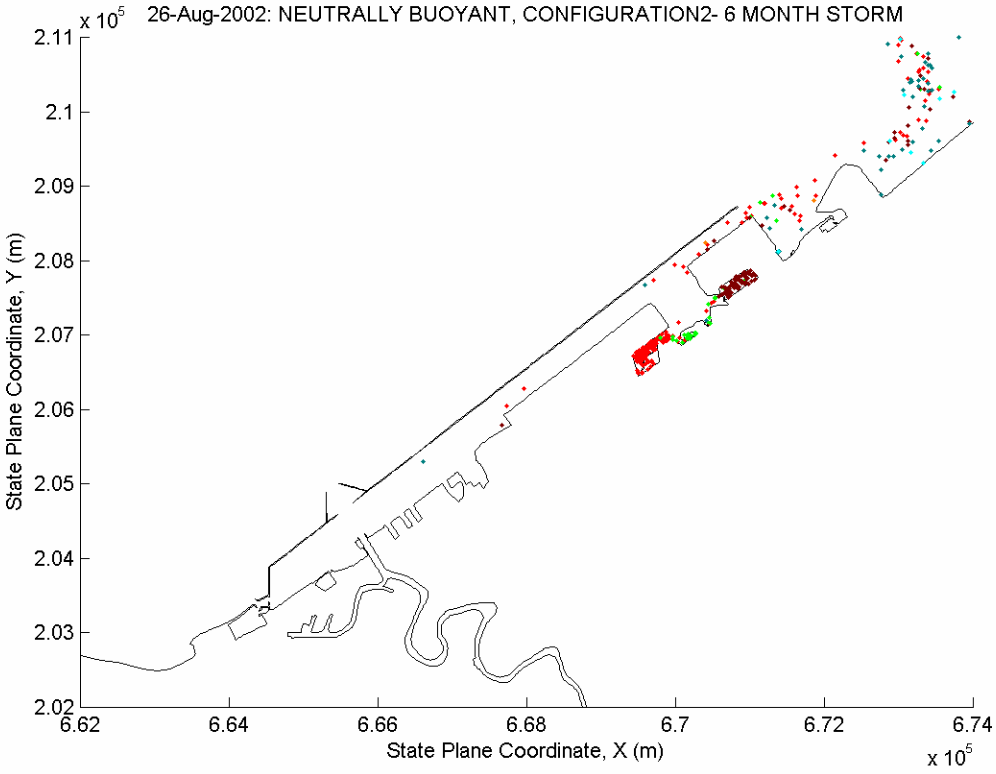
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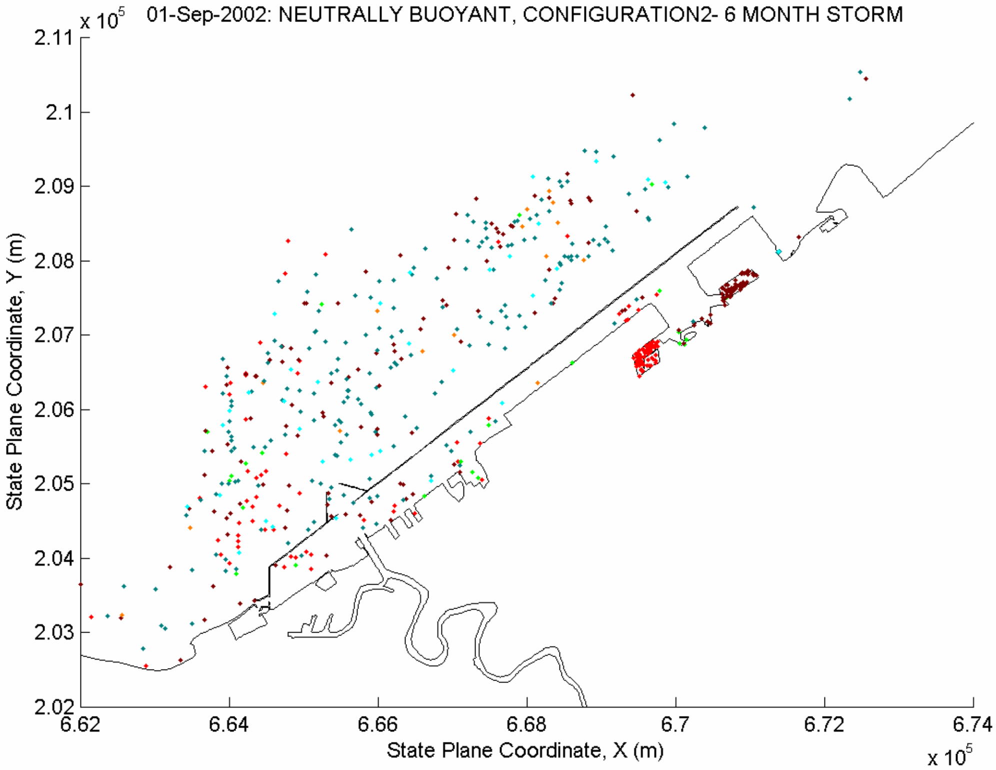
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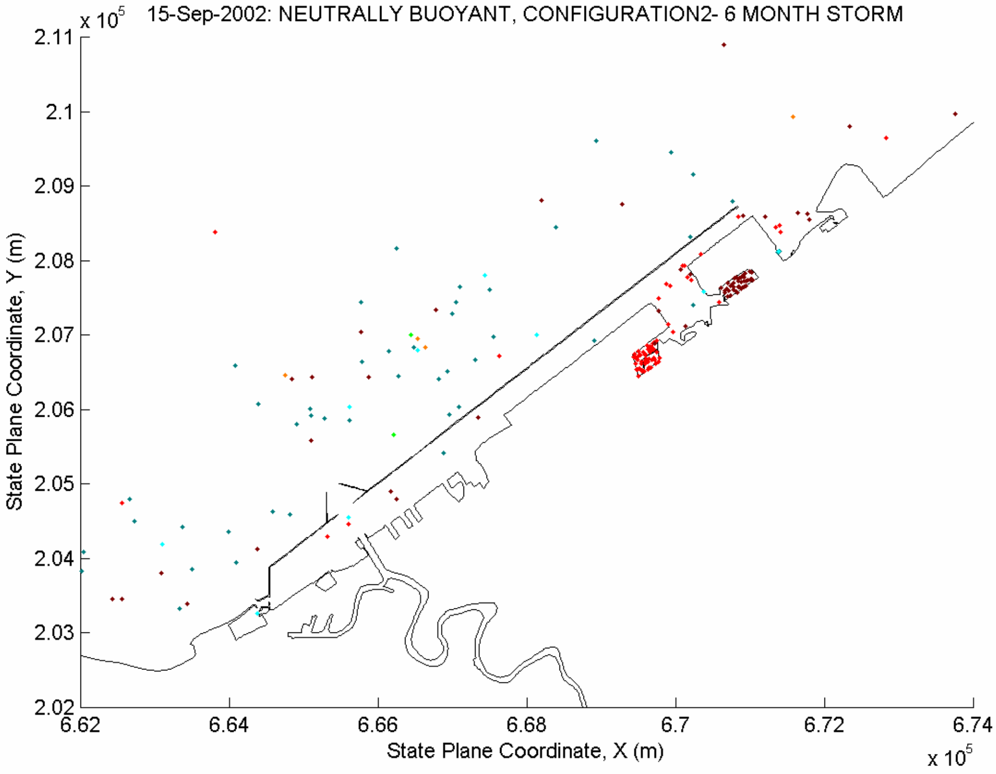
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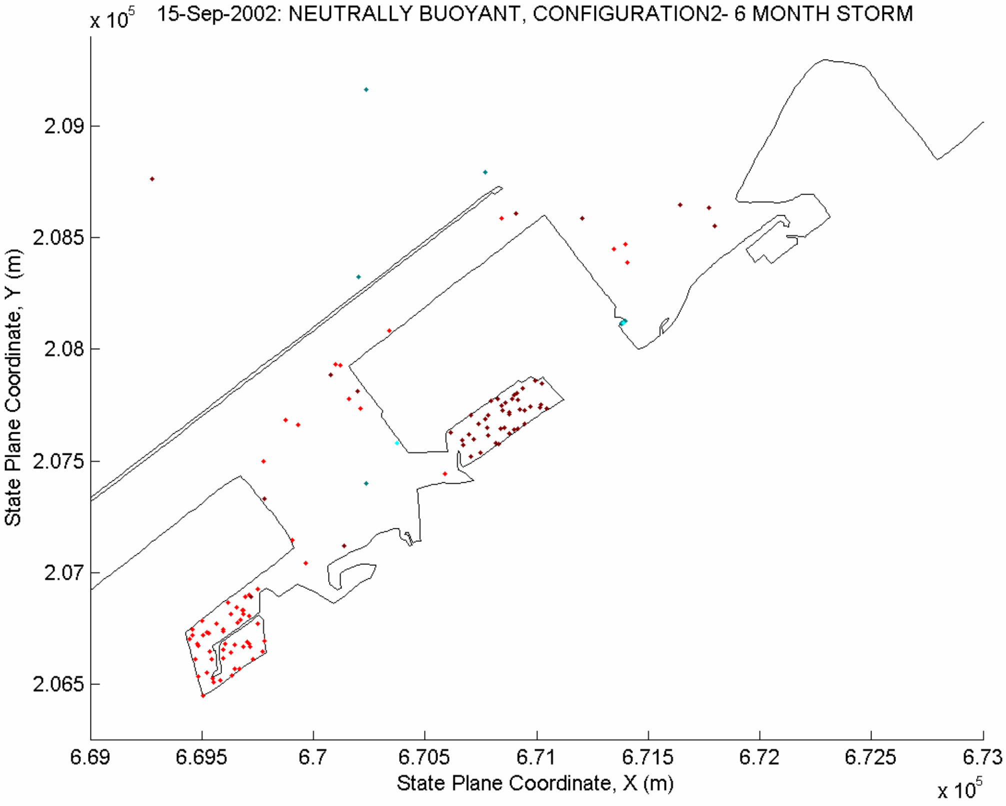
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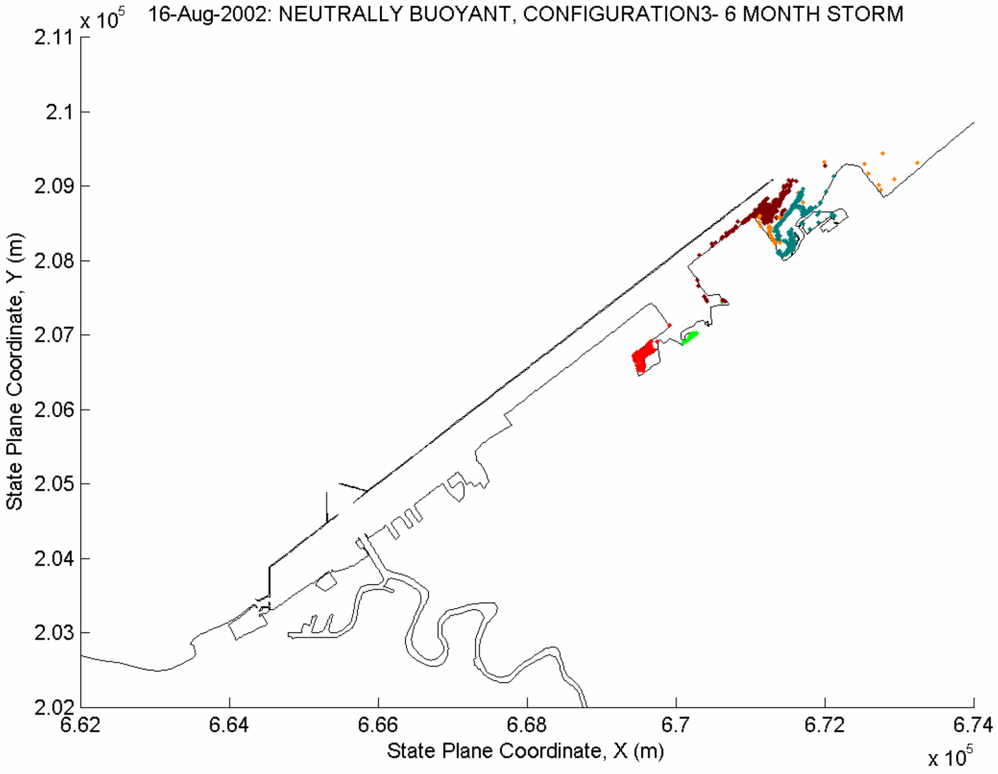
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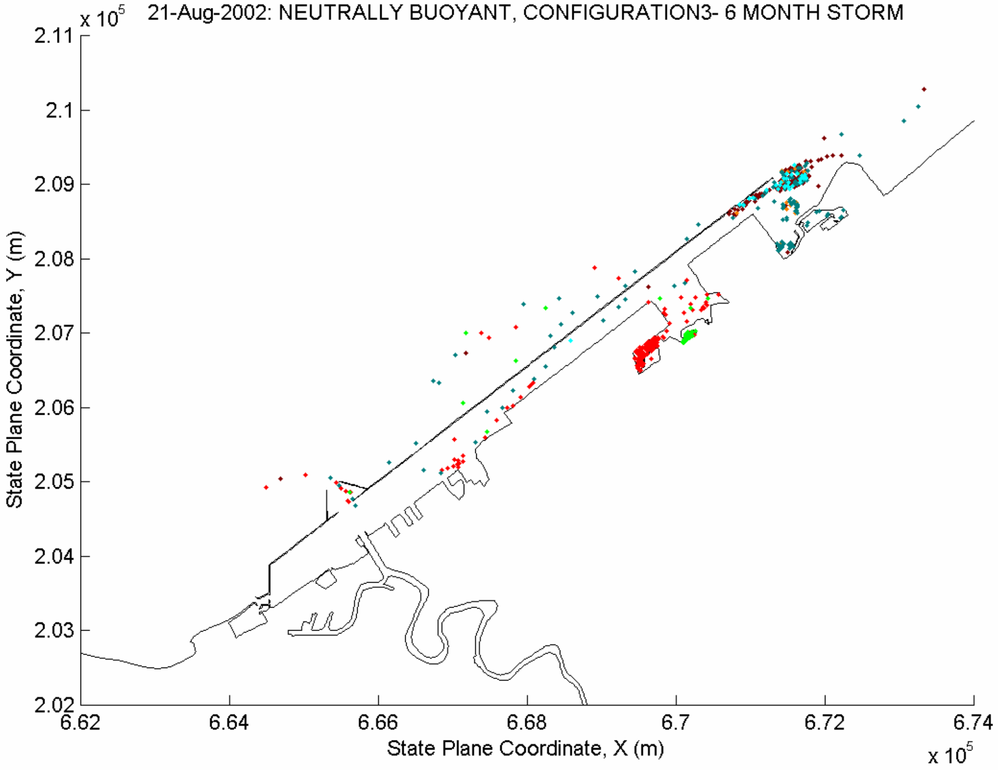
x 10^5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State Plane Coordinate, X (m)
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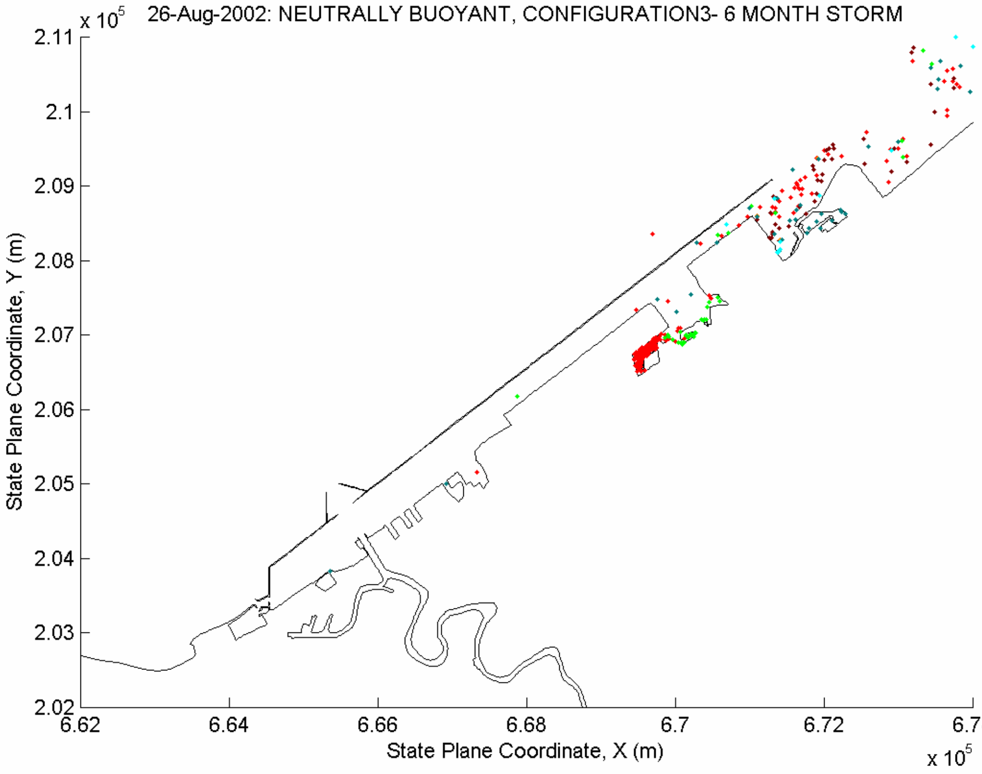
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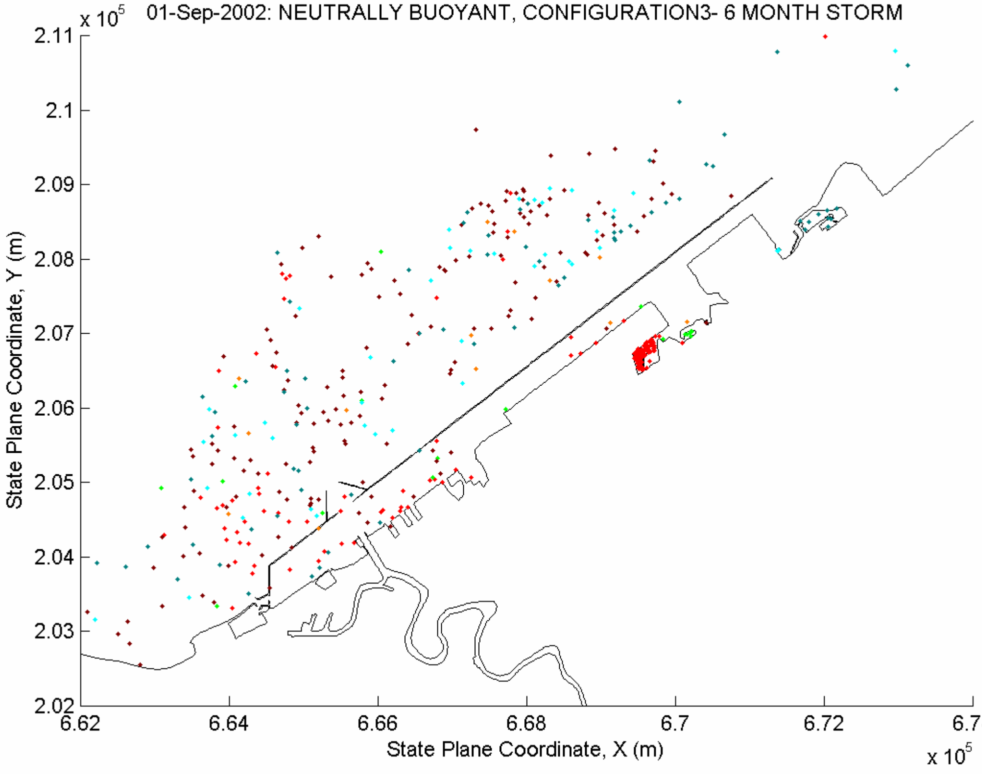
x 10^5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State Plane Coordinate, Y (m)
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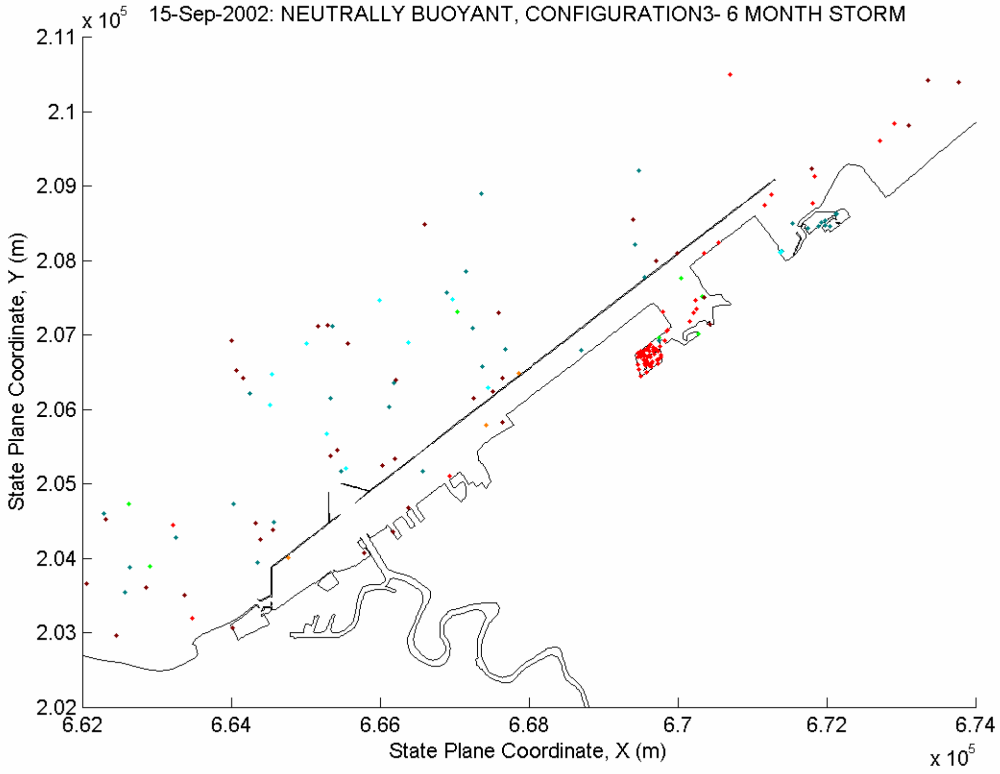
State Plane Coordinate, X (m)
x 10^5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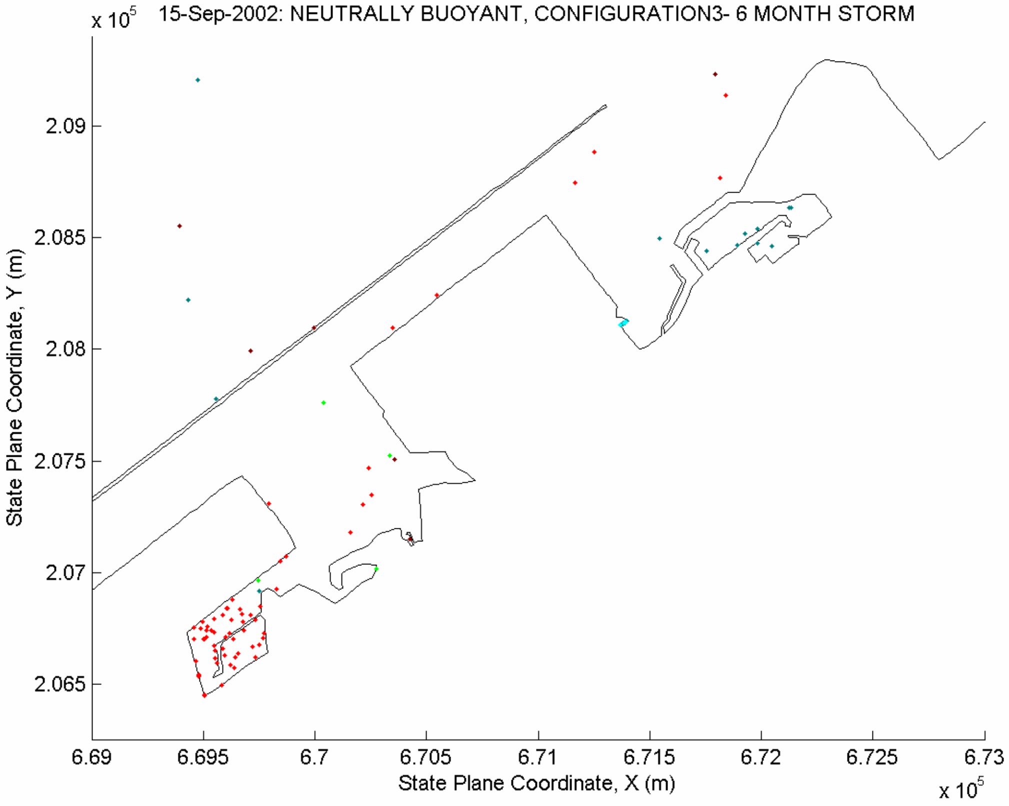
State Plane Coordinate, X (m)
x 10^5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State Plane Coordinate, Y (m)
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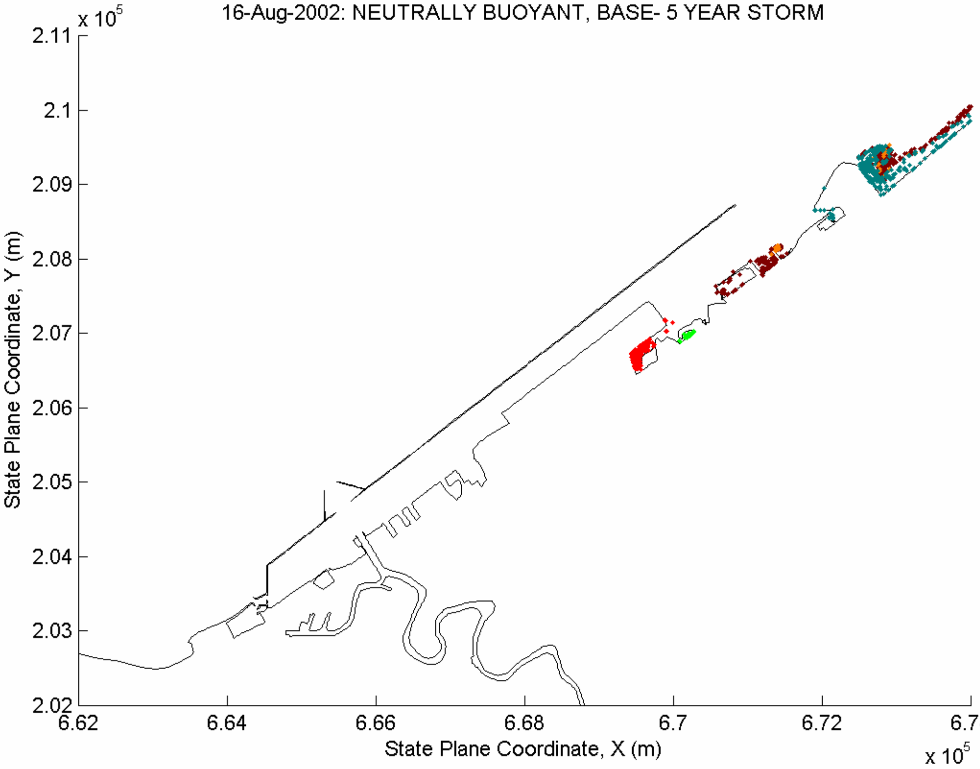
State Plane Coordinate, X (m)
x 10^5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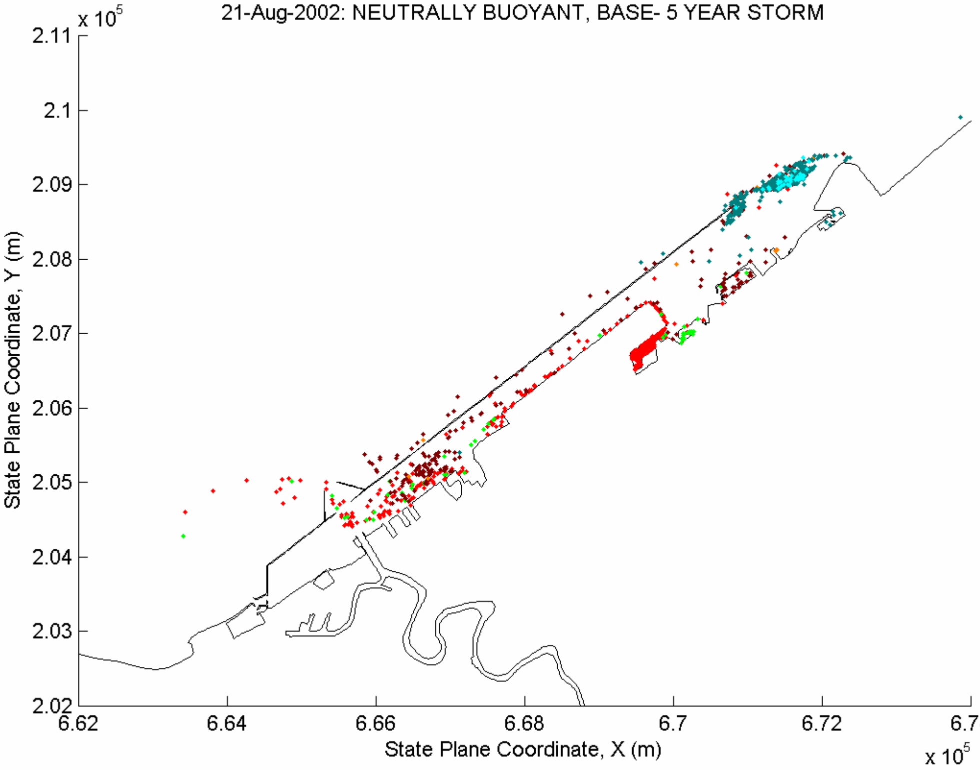
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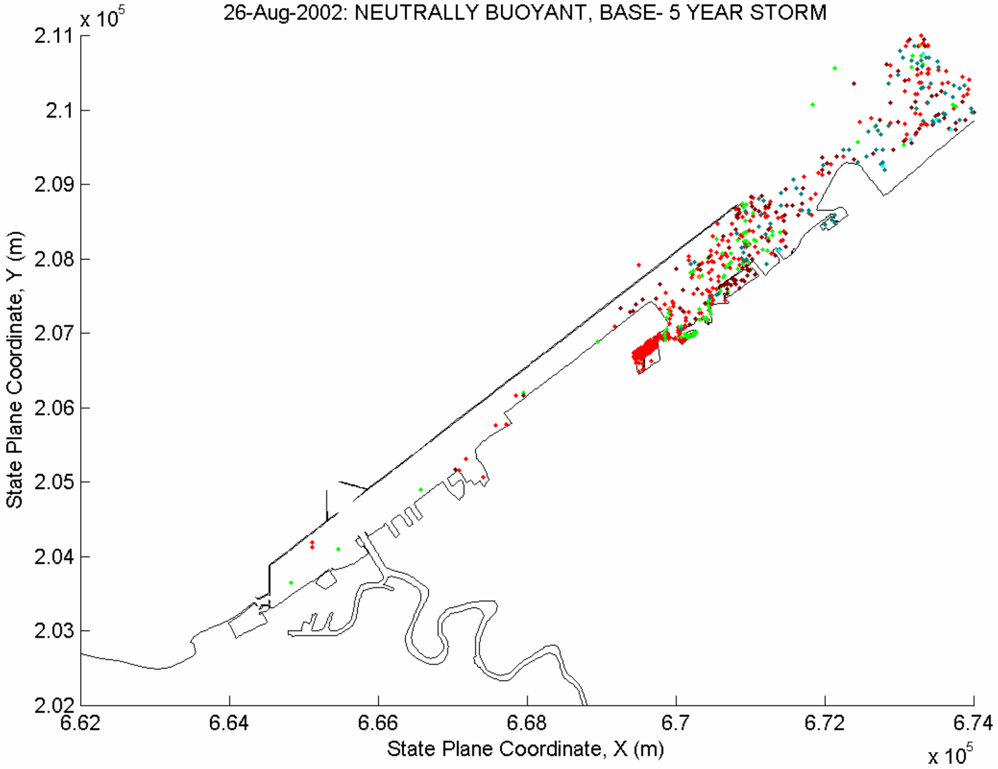
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State Plane Coordinate, Y (m)
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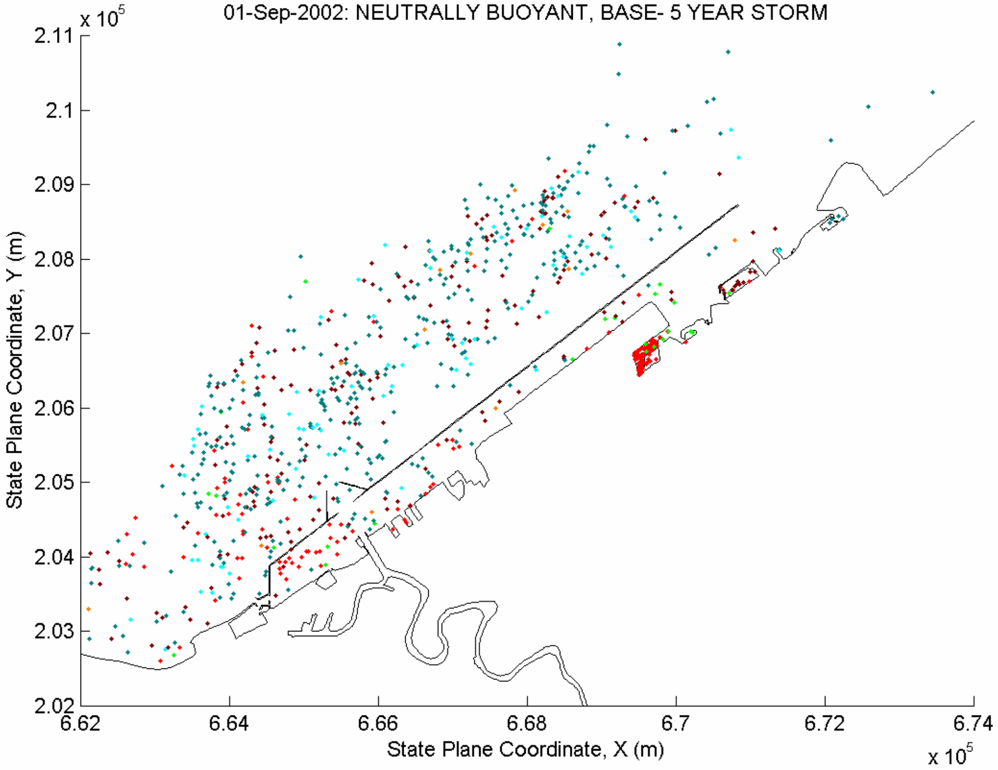
State Plane Coordinate, X (m)
x 10^5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State Plane Coordinate, Y (m)
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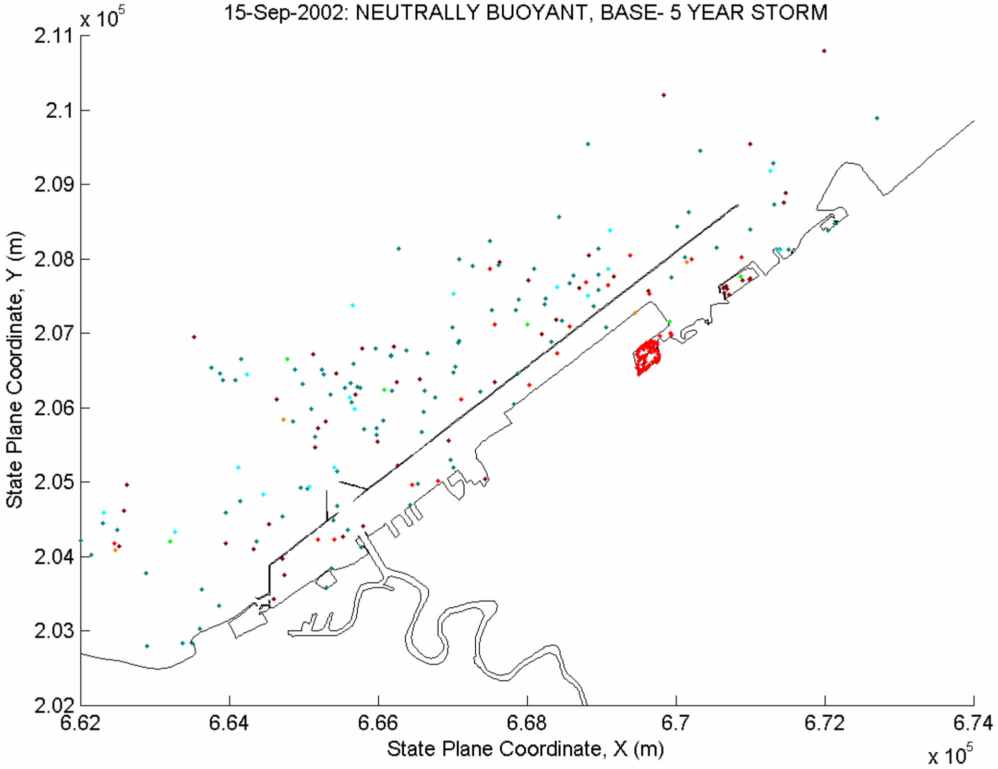
State Plane Coordinate, X (m)
x 10^5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x 10^5
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State Plane Coordinate, Y (m)
6.62
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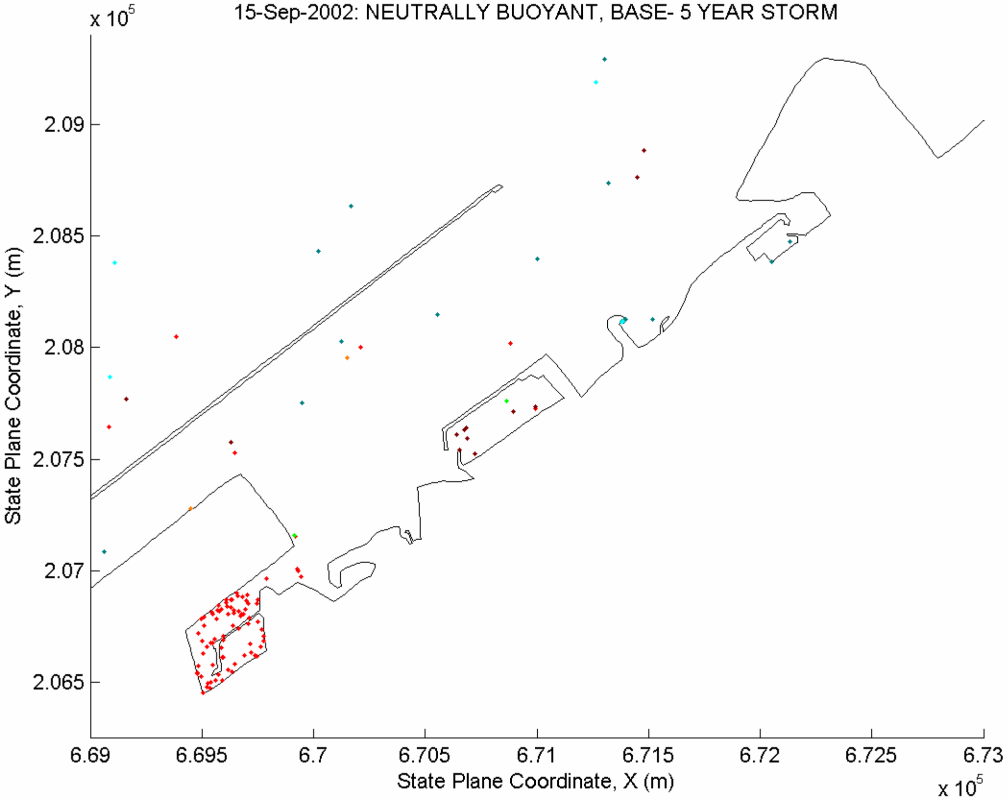
6.74
State Plane Coordinate, X (m)
x 10^5


15-Sep-2002: NEUTRALLY BUOYANT, BASE- 5 YEAR STORM
x 10^5
2.09
2.085
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State Plane Coordinate, Y (m)
6.69
6.695
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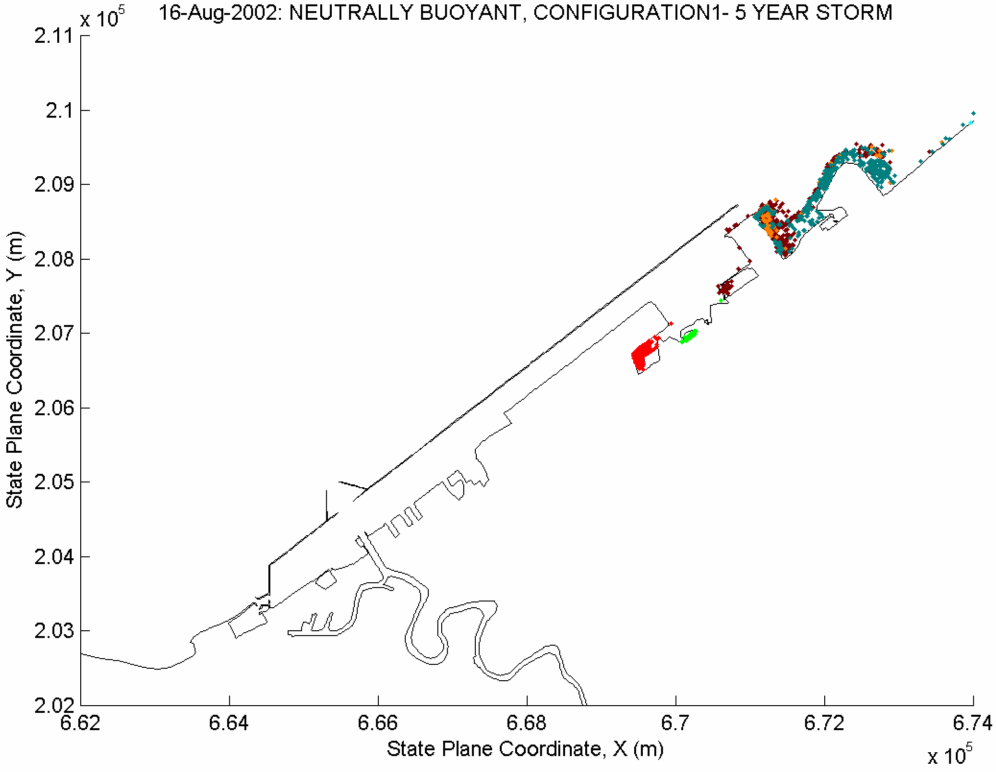
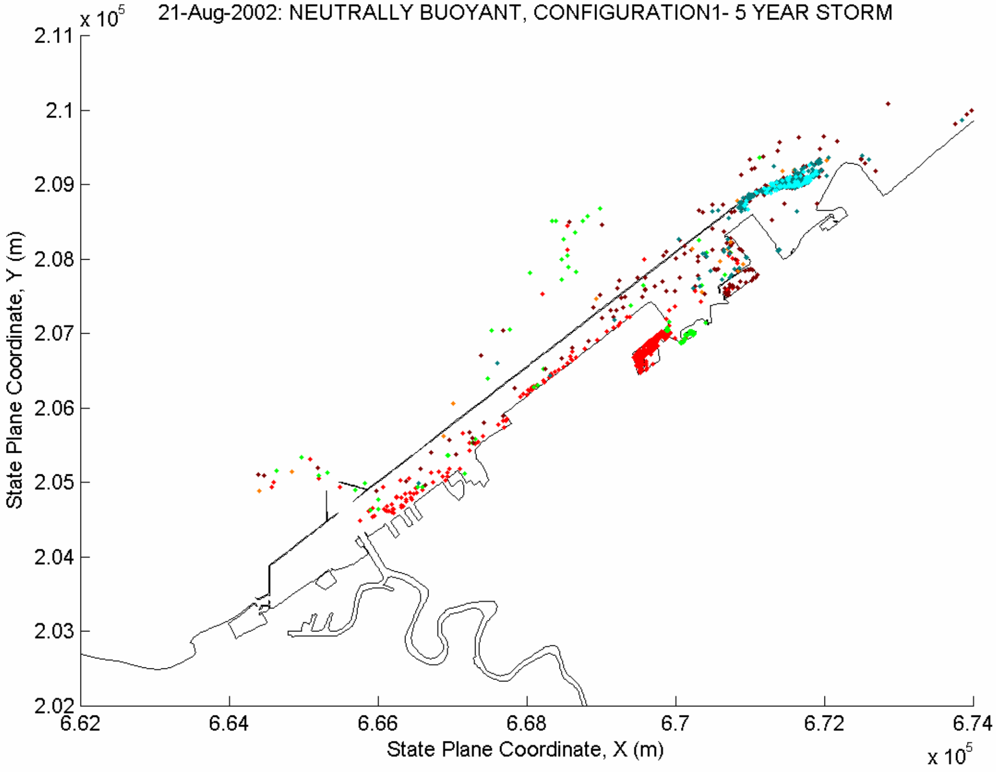
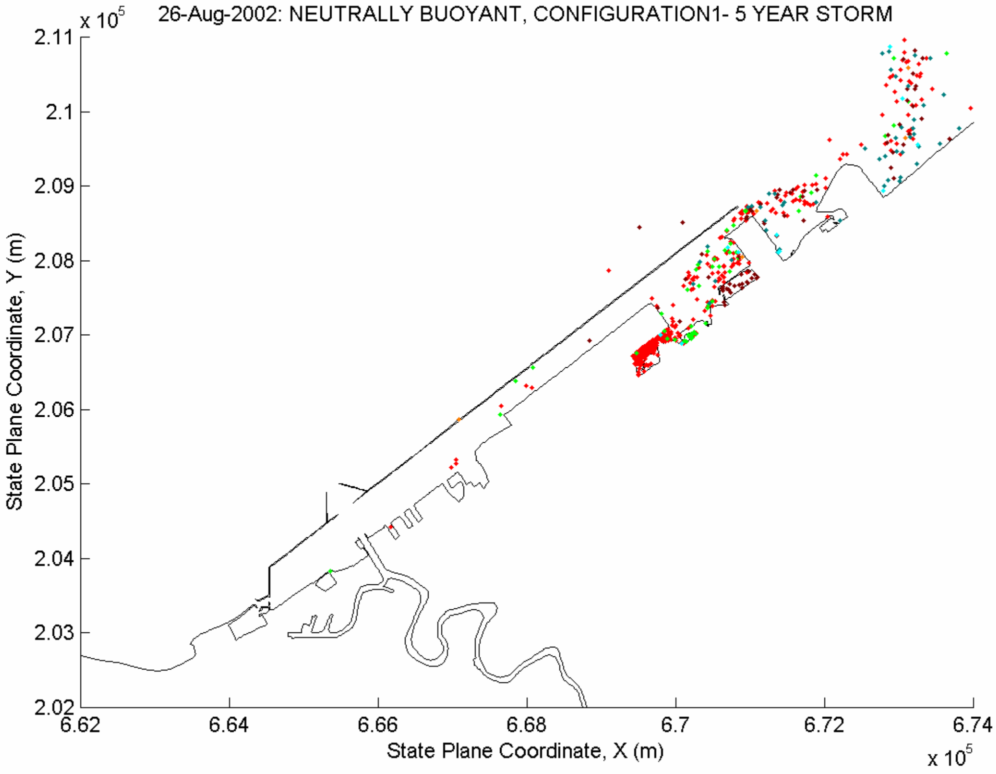
6.705
6.71
6.715
6.72
6.725
6.73
State Plane Coordinate, X (m)
x 10^5

16-Aug-2002: NEUTRALLY BUOYANT, CONFIGURATION1- 5 YEAR STORM



21-Aug-2002: NEUTRALLY BUOYANT, CONFIGURATION1- 5 YEAR STORM




26-Aug-2002: NEUTRALLY BUOYANT, CONFIGURATION1- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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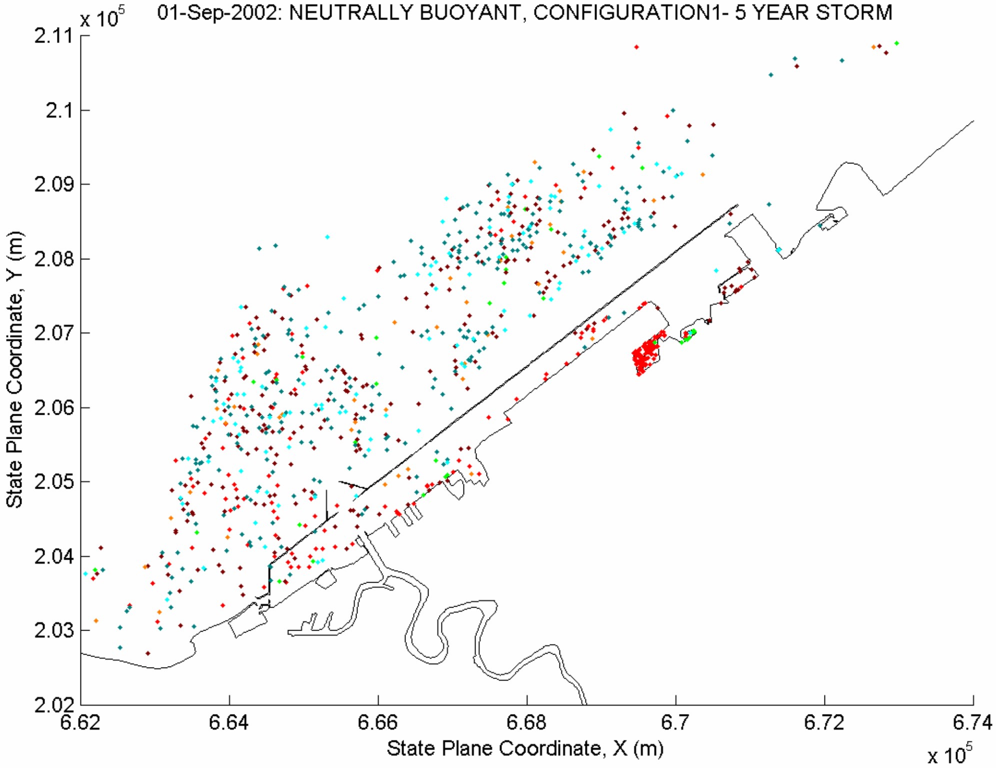
State Plane Coordinate, X (m)
x 10^5


01-Sep-2002: NEUTRALLY BUOYANT, CONFIGURATION1- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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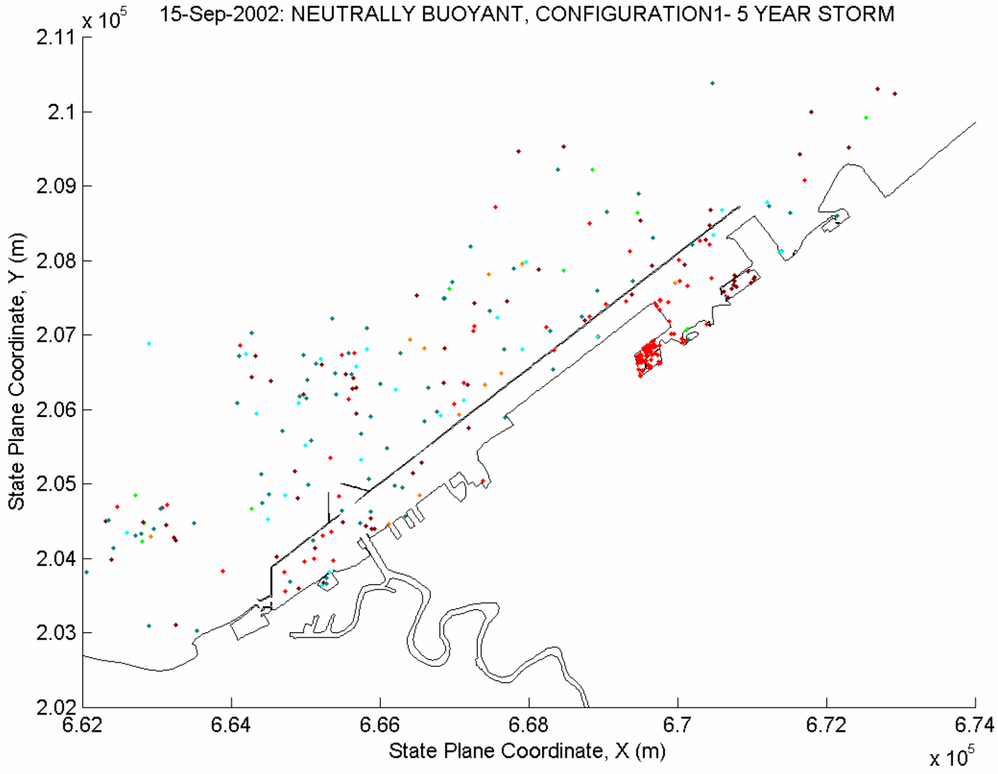
State Plane Coordinate, X (m)
x 10^5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x 10^5
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State Plane Coordinate, Y (m)
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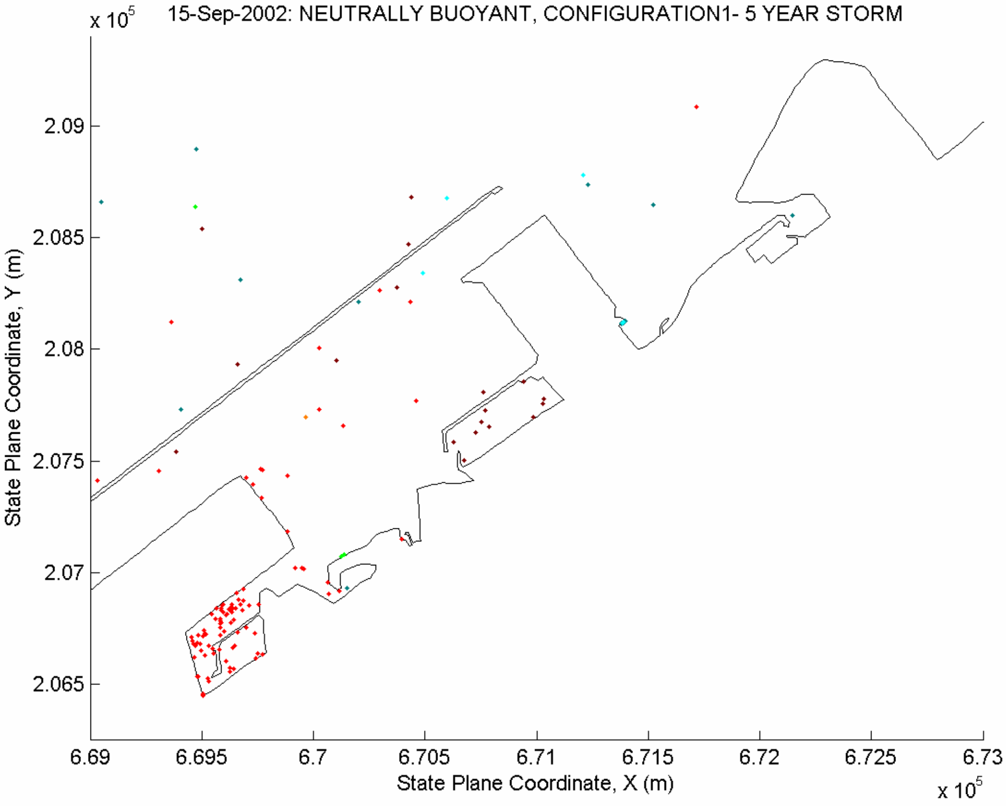
State Plane Coordinate, X (m)
x 10^5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x 10^5
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State Plane Coordinate, Y (m)
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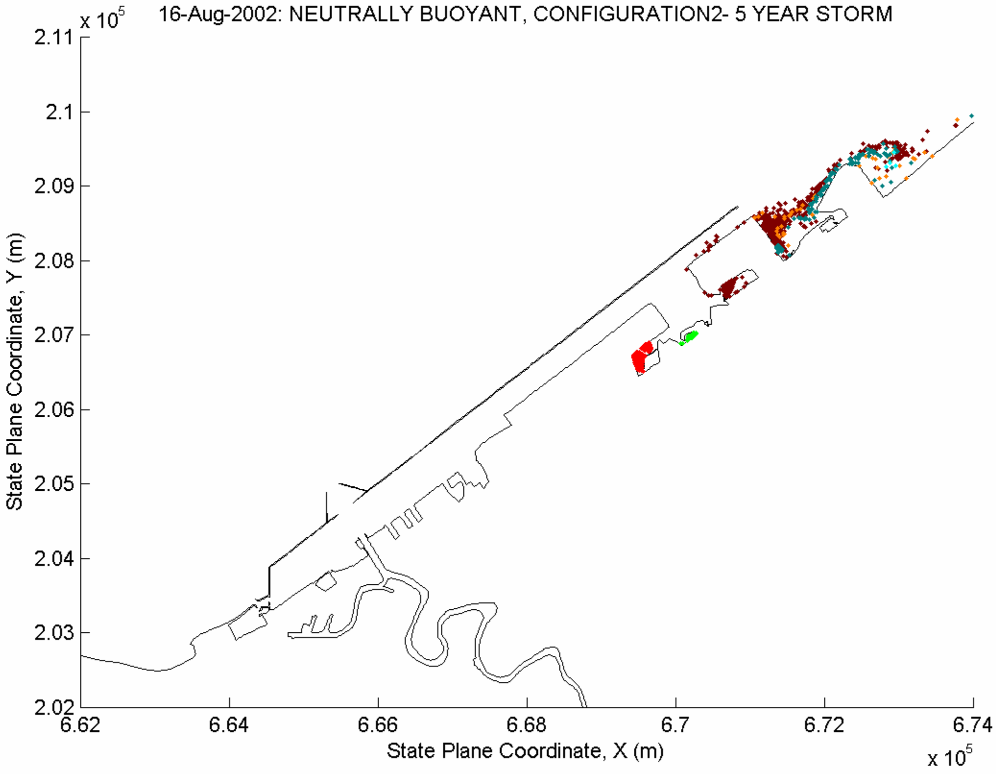
State Plane Coordinate, X (m)
x 10^5


16-Aug-2002: NEUTRALLY BUOYANT, CONFIGURATION2- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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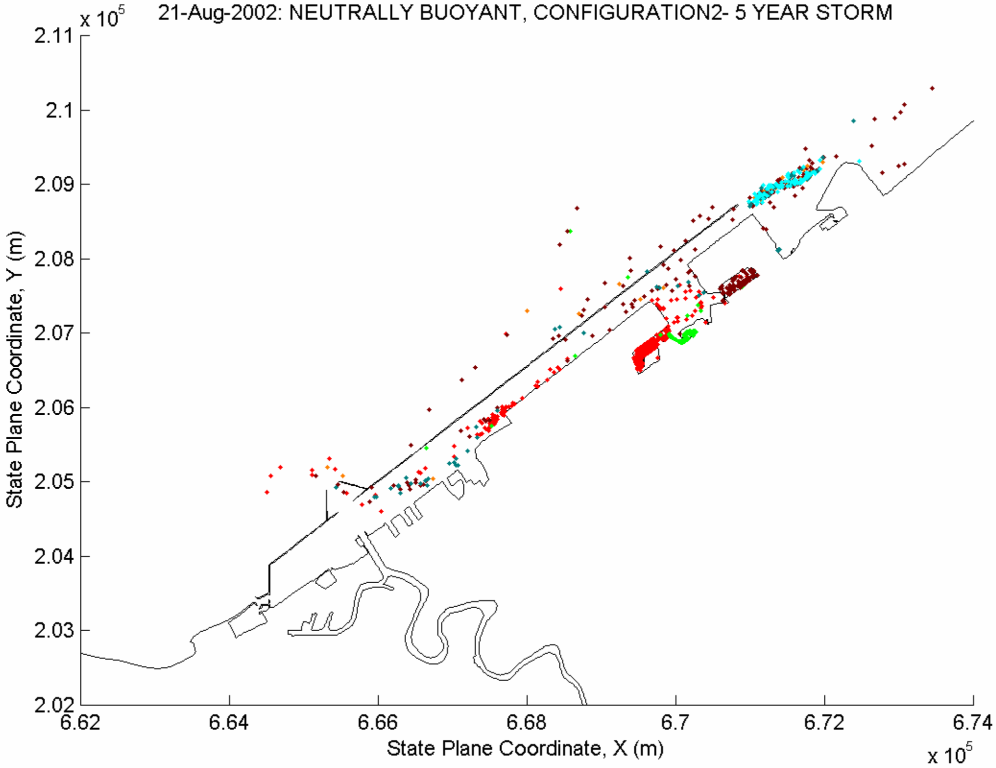
6.74
State Plane Coordinate, X (m)
x 10^5


21-Aug-2002: NEUTRALLY BUOYANT, CONFIGURATION2- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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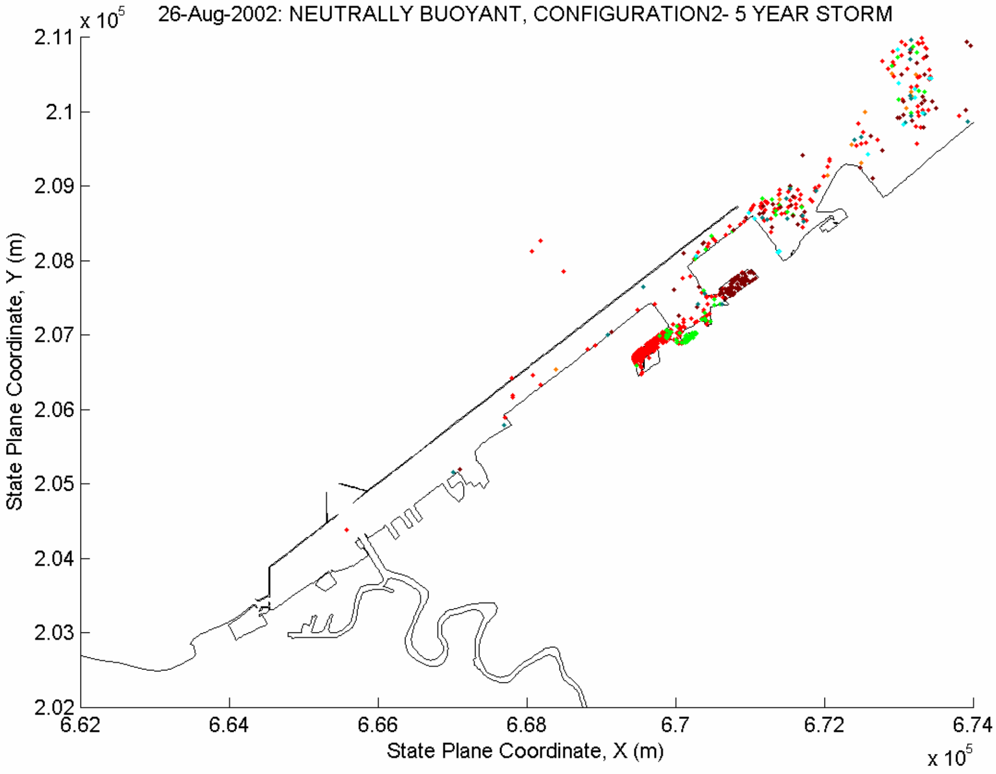
6.74
State Plane Coordinate, X (m)
x 10^5


26-Aug-2002: NEUTRALLY BUOYANT, CONFIGURATION2- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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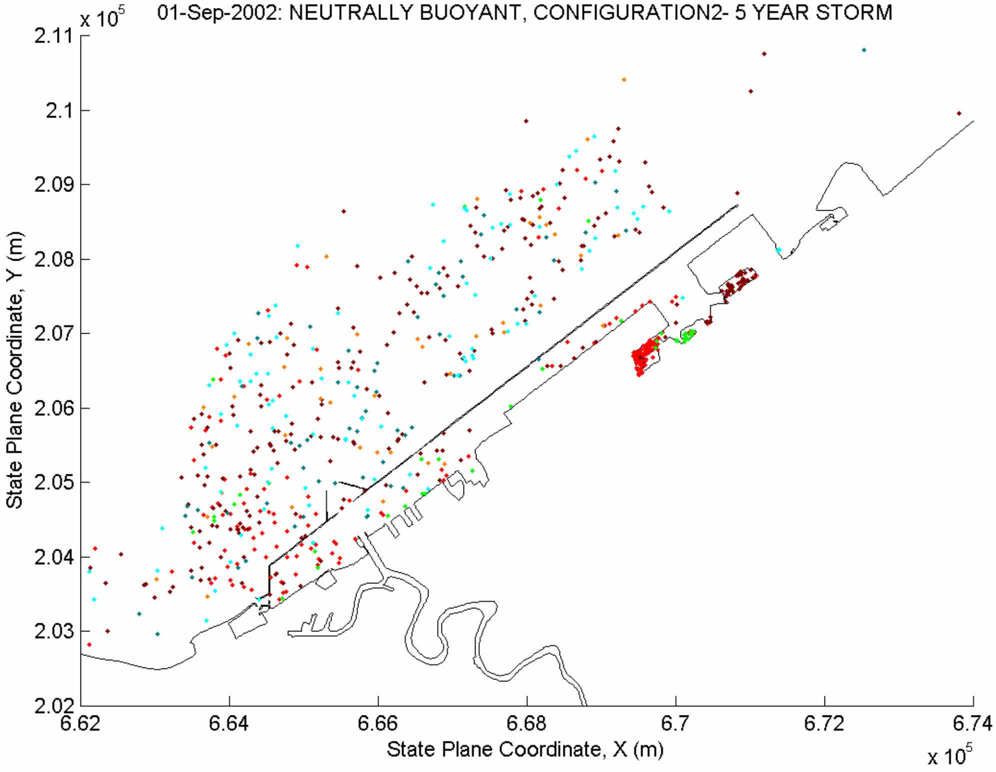
State Plane Coordinate, X (m)
x 10^5


01-Sep-2002: NEUTRALLY BUOYANT, CONFIGURATION2- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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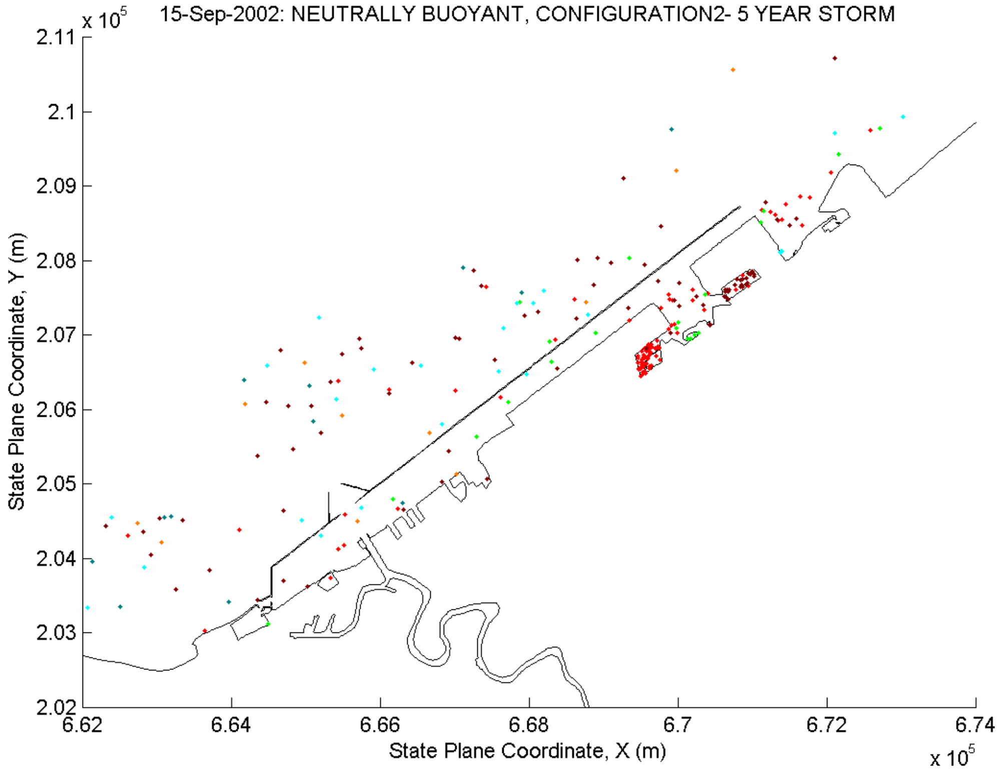
State Plane Coordinate, X (m)
x 10^5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x 10^5
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State Plane Coordinate, Y (m)
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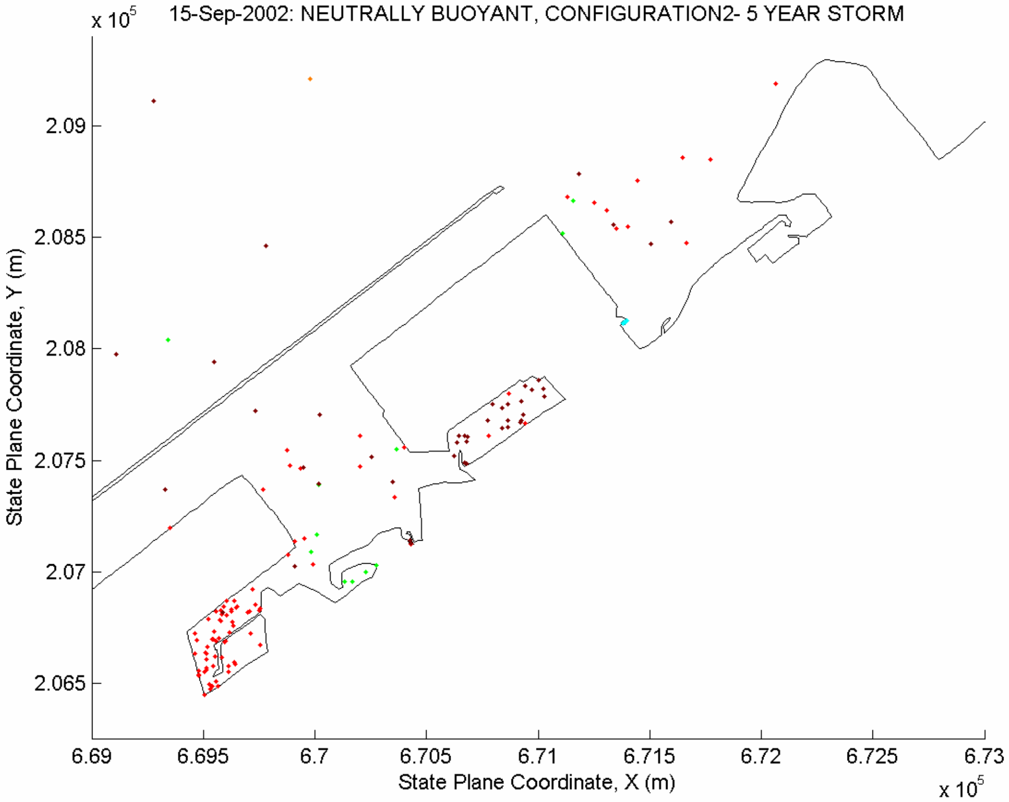
State Plane Coordinate, X (m)
x 10^5


15-Sep-2002: NEUTRALLY BUOYANT, CONFIGURATION2- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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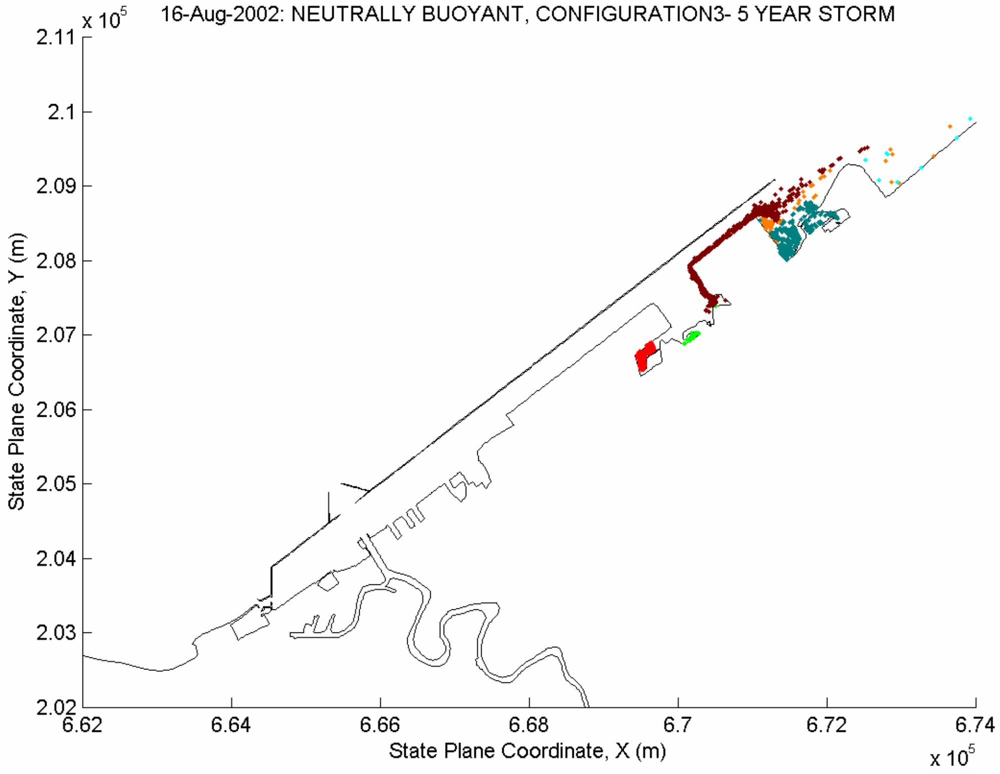
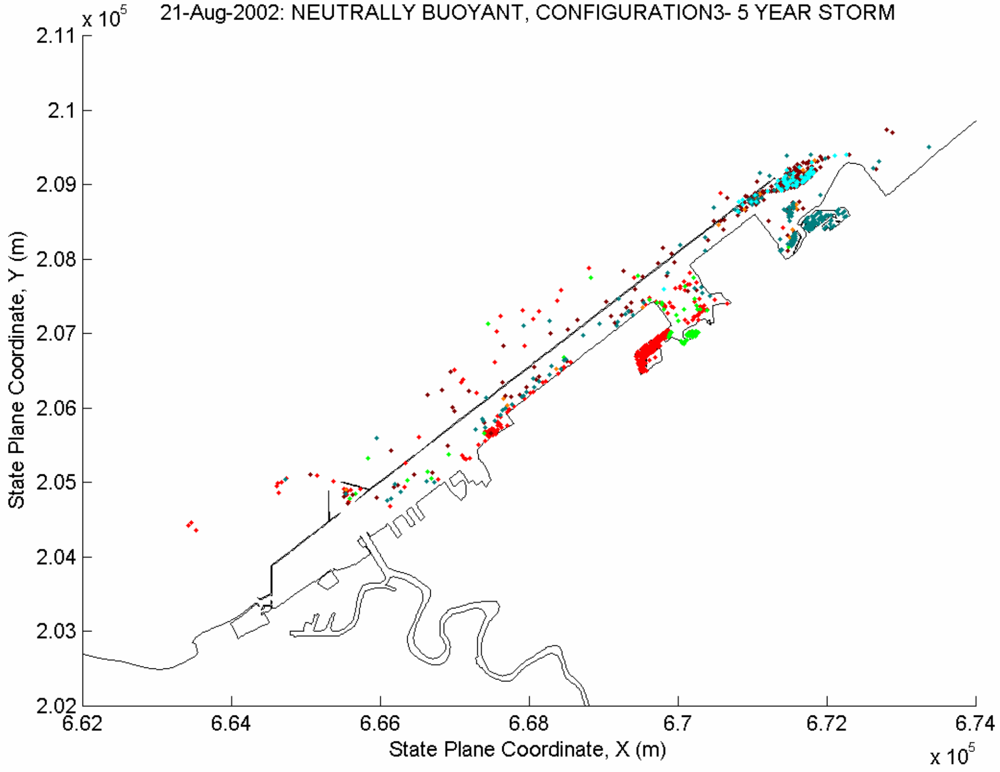
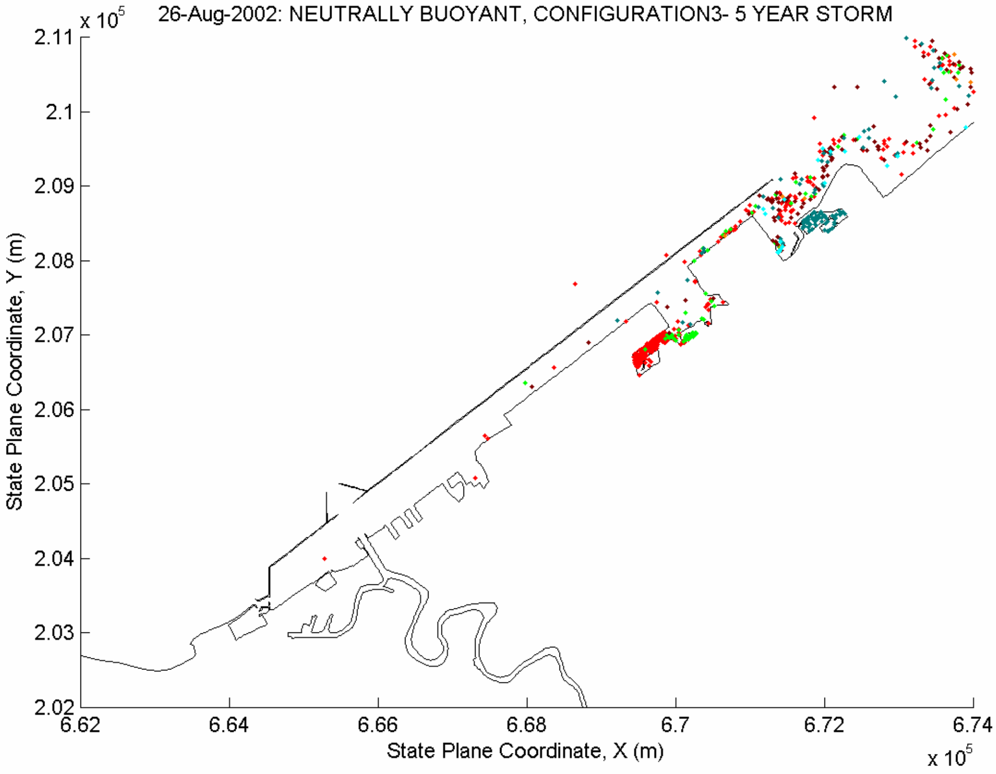
State Plane Coordinate, X (m)
x 10^5



16-Aug-2002: NEUTRALLY BUOYANT, CONFIGURATION3- 5 YEAR STORM



21-Aug-2002: NEUTRALLY BUOYANT, CONFIGURATION3- 5 YEAR STORM


x 10^5
26-Aug-2002: NEUTRALLY BUOYANT, CONFIGURATION3- 5 YEAR STORM
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State Plane Coordinate, Y (m)
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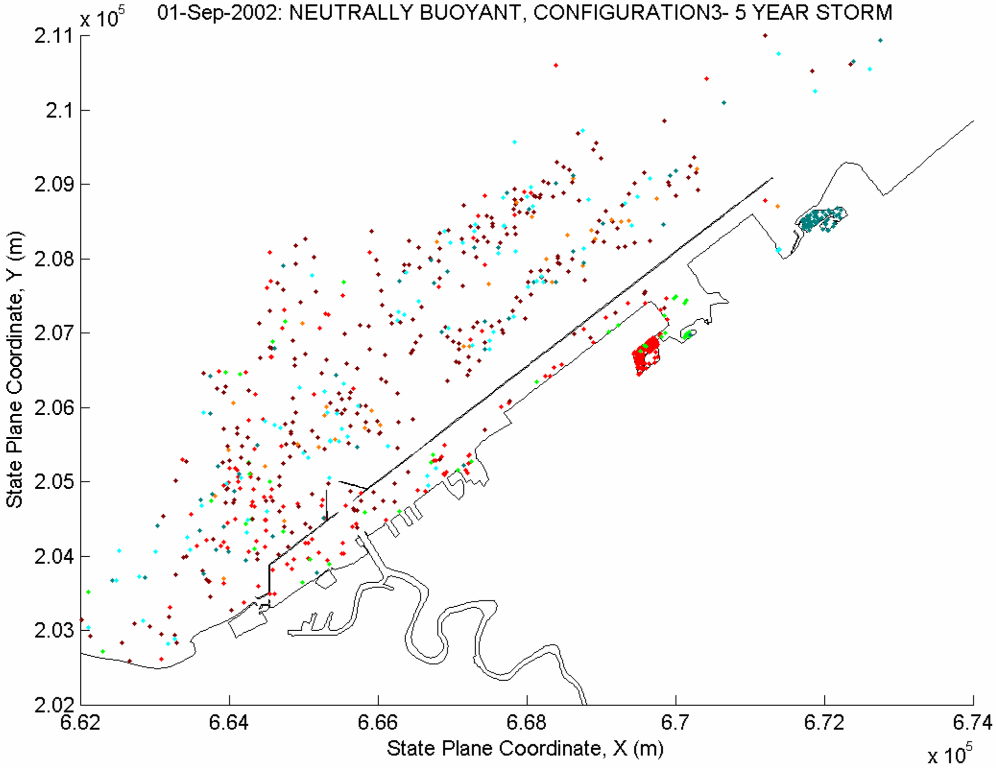
State Plane Coordinate, X (m)
x 10^5


x 10^5
01-Sep-2002: NEUTRALLY BUOYANT, CONFIGURATION3- 5 YEAR STORM
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State Plane Coordinate, Y (m)
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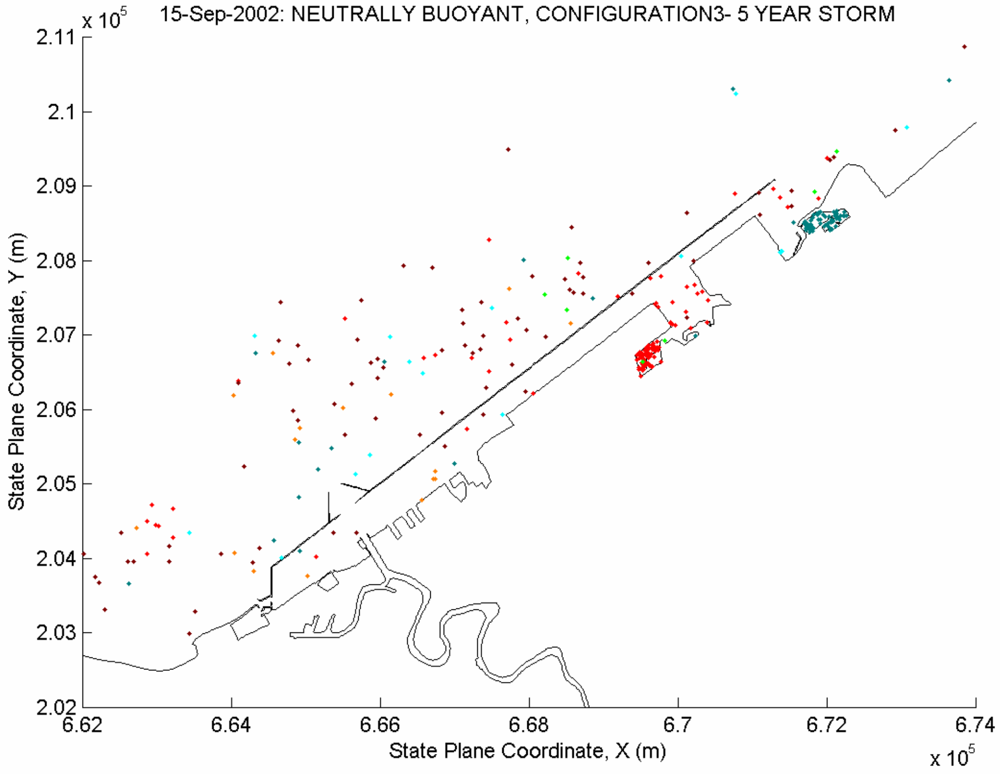
State Plane Coordinate, X (m)
x 10^5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State Plane Coordinate, Y (m)
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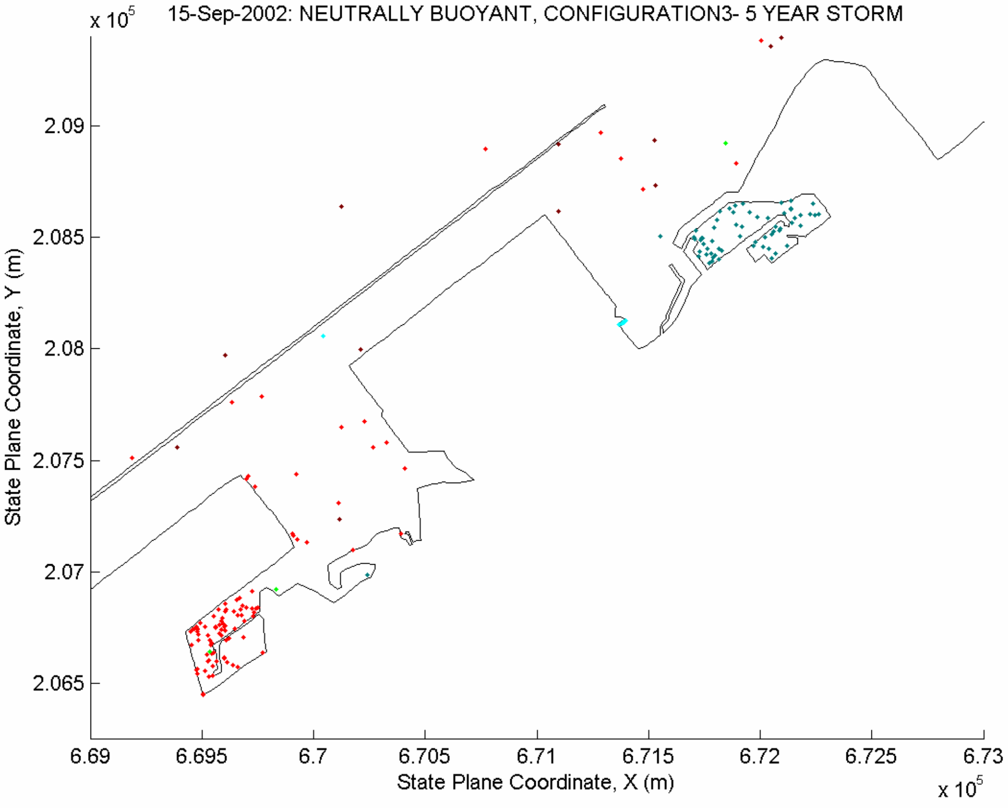
State Plane Coordinate, X (m)
x 10^5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State Plane Coordinate, Y (m)
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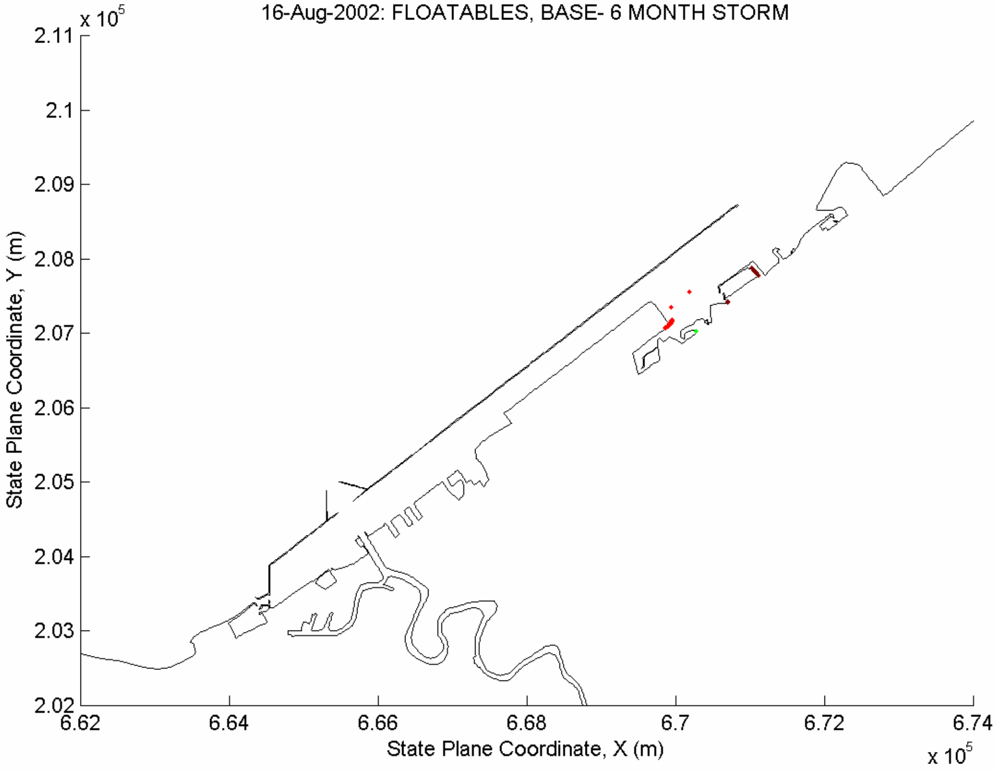
State Plane Coordinate, X (m)
x 10^5


16-Aug-2002: FLOATABLES, BASE- 6 MONTH STORM
x 10^5
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State Plane Coordinate, Y (m)
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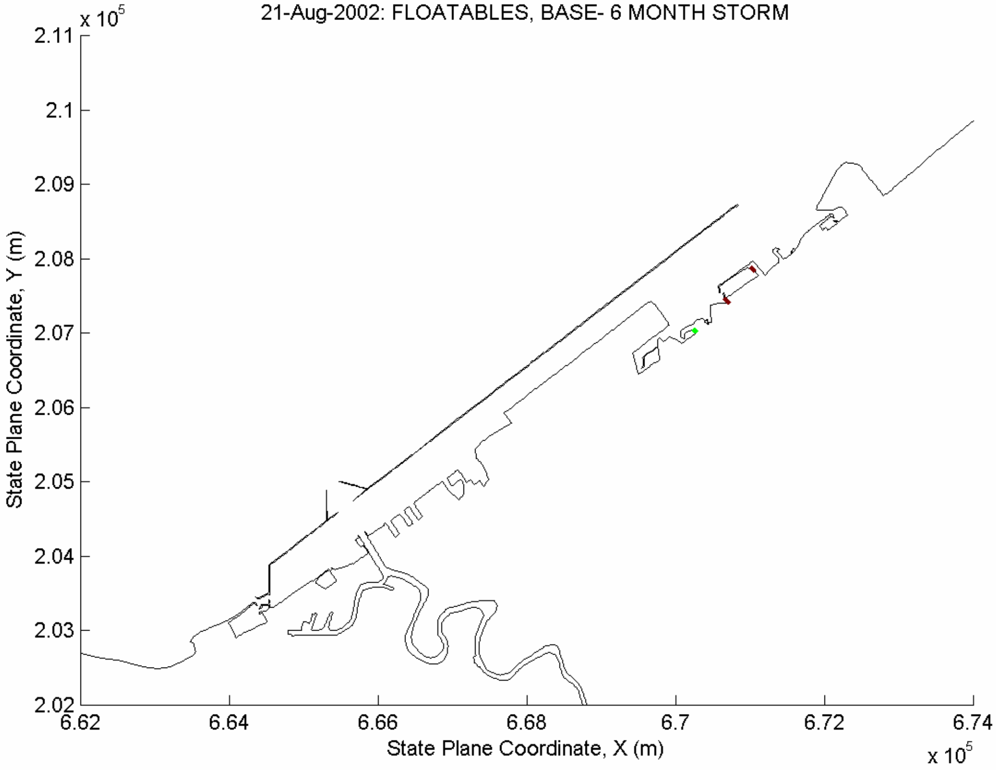
State Plane Coordinate, X (m)
x 10^5


21-Aug-2002: FLOATABLES, BASE- 6 MONTH STORM
x 10^5
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State Plane Coordinate, Y (m)
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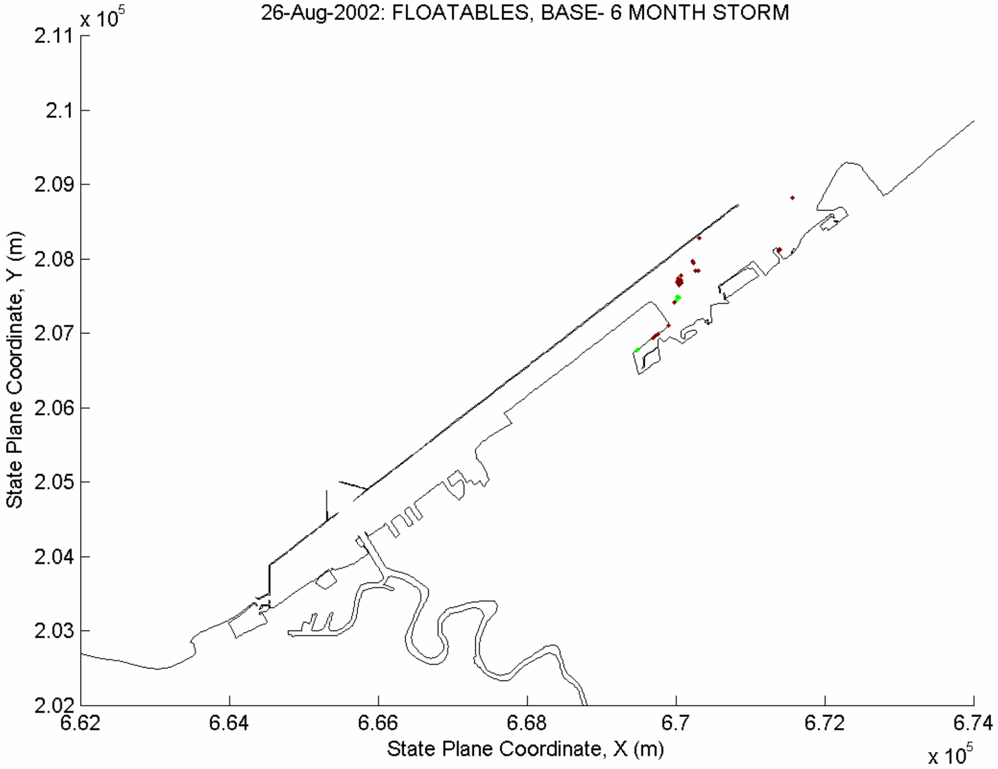
State Plane Coordinate, X (m)
x 10^5


26-Aug-2002: FLOATABLES, BASE- 6 MONTH STORM
x 10^5
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State Plane Coordinate, Y (m)
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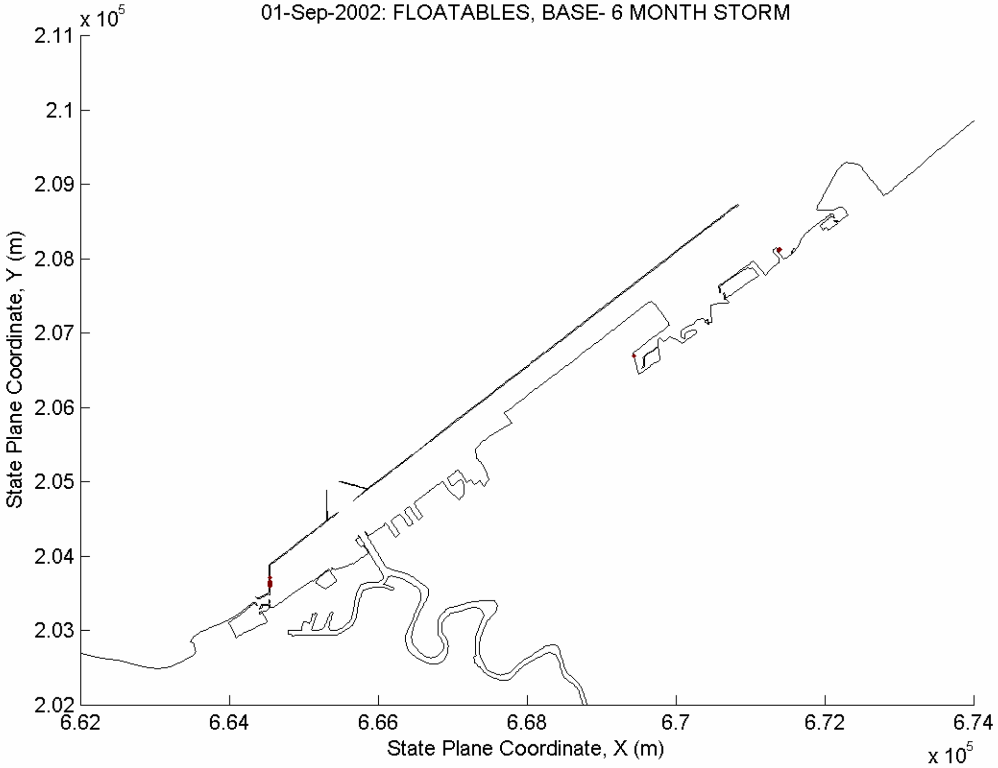
State Plane Coordinate, X (m)
x 10^5


01-Sep-2002: FLOATABLES, BASE- 6 MONTH STORM
x 10^5
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State Plane Coordinate, Y (m)
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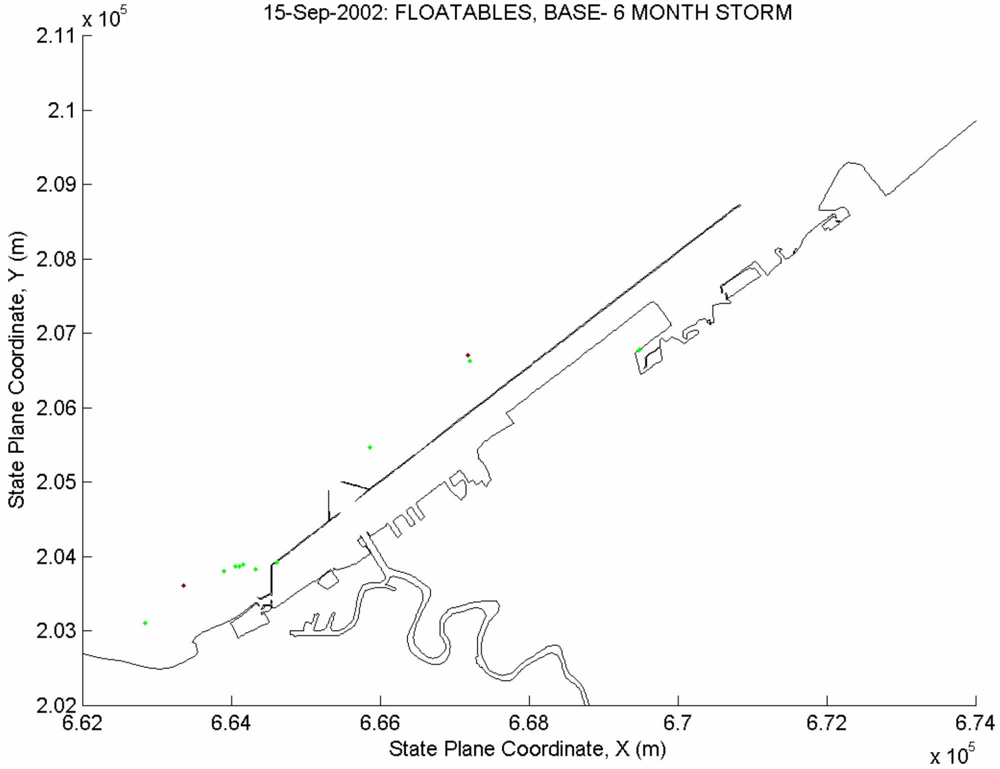
State Plane Coordinate, X (m)
x 10^5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x 10^5
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State Plane Coordinate, Y (m)
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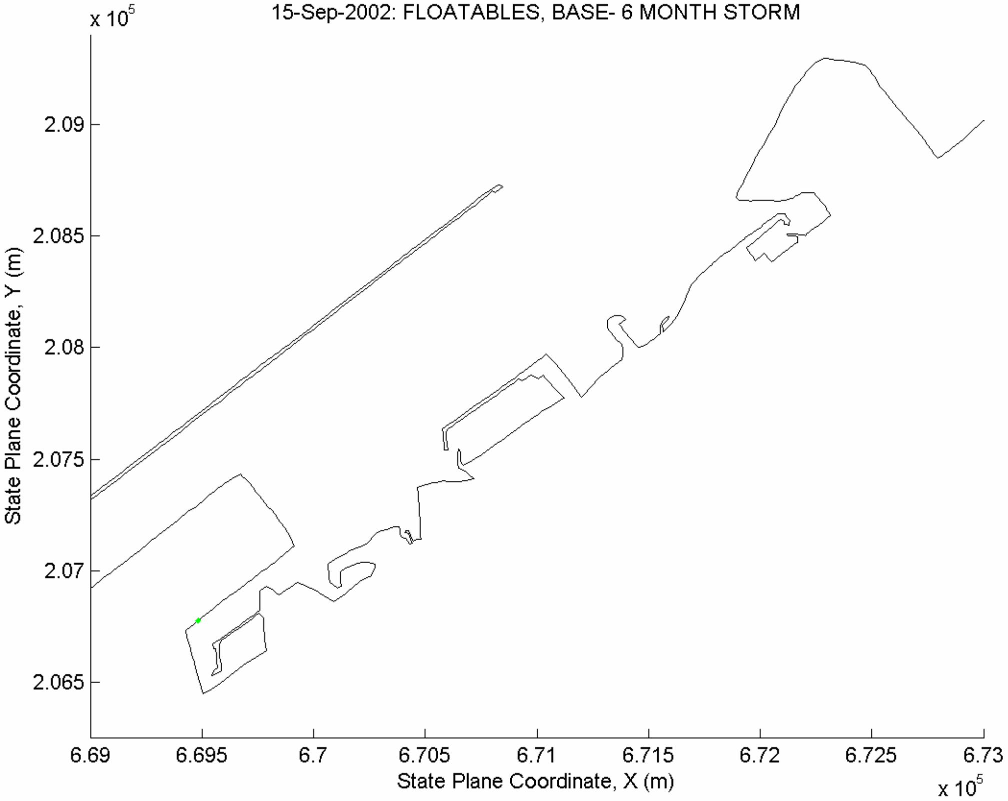
State Plane Coordinate, X (m)
x 10^5


15-Sep-2002: FLOATABLES, BASE- 6 MONTH STORM
x 10^5
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State Plane Coordinate, Y (m)
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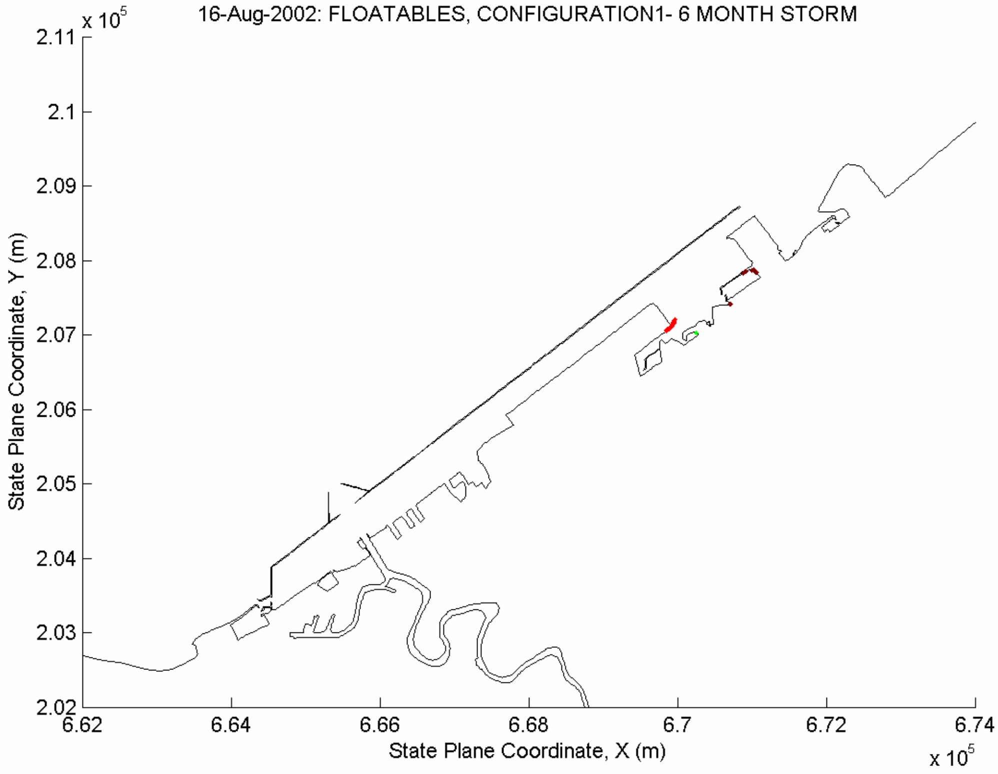
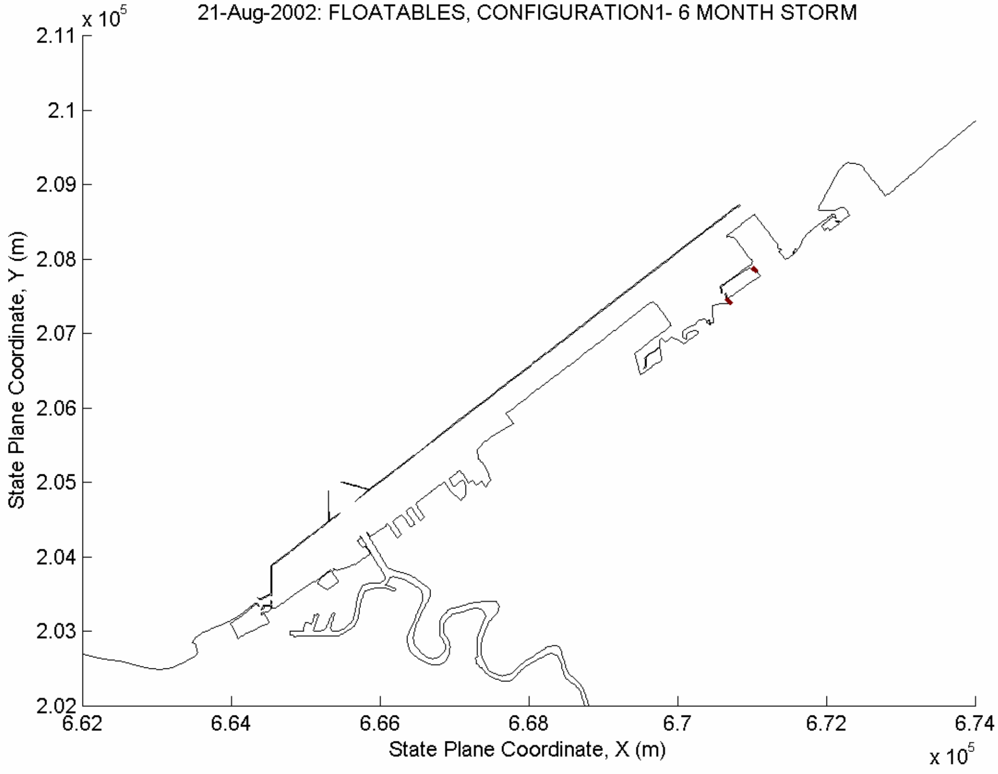
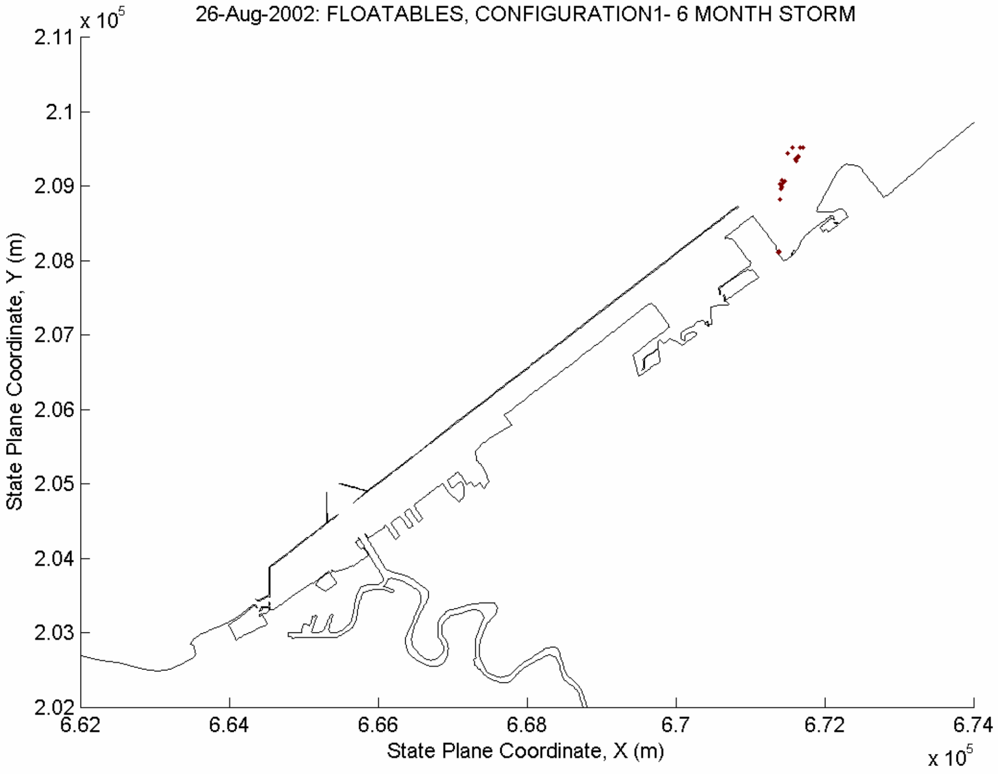
State Plane Coordinate, X (m)
x 10^5


16-Aug-2002: FLOATABLES, CONFIGURATION1- 6 MONTH STORM


21-Aug-2002: FLOATABLES, CONFIGURATION1- 6 MONTH STORM


26-Aug-2002: FLOATABLES, CONFIGURATION1- 6 MONTH STORM
x 10^5
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State Plane Coordinate, Y (m)
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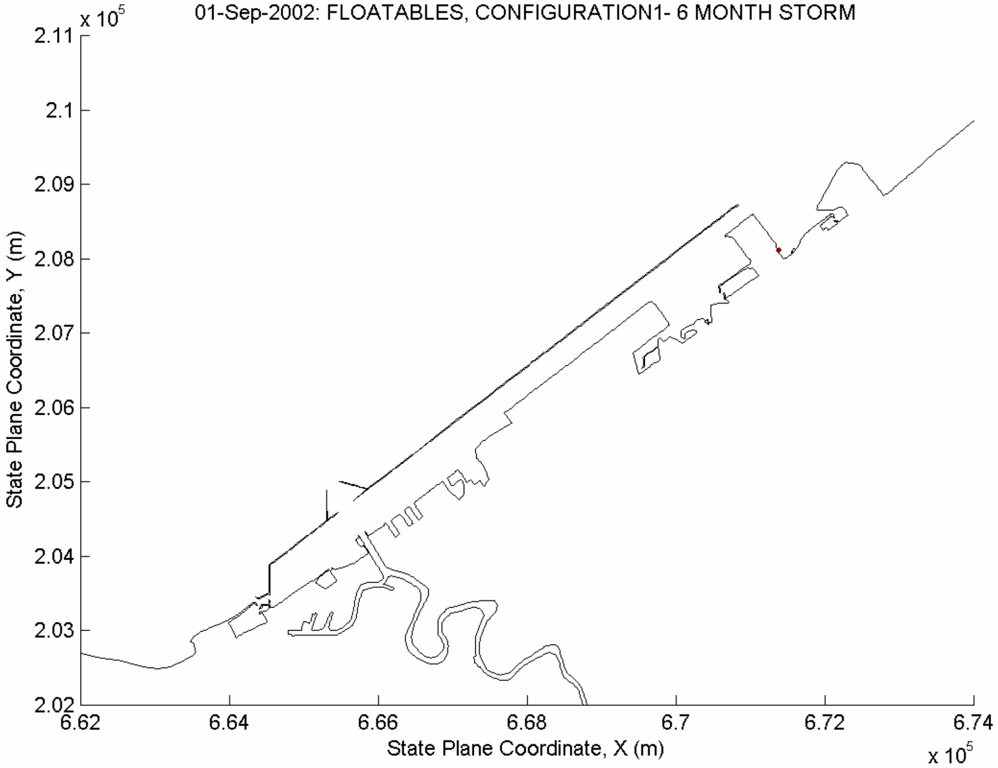
State Plane Coordinate, X (m)
x 10^5


01-Sep-2002: FLOATABLES, CONFIGURATION1- 6 MONTH STORM
x 10^5
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State Plane Coordinate, Y (m)
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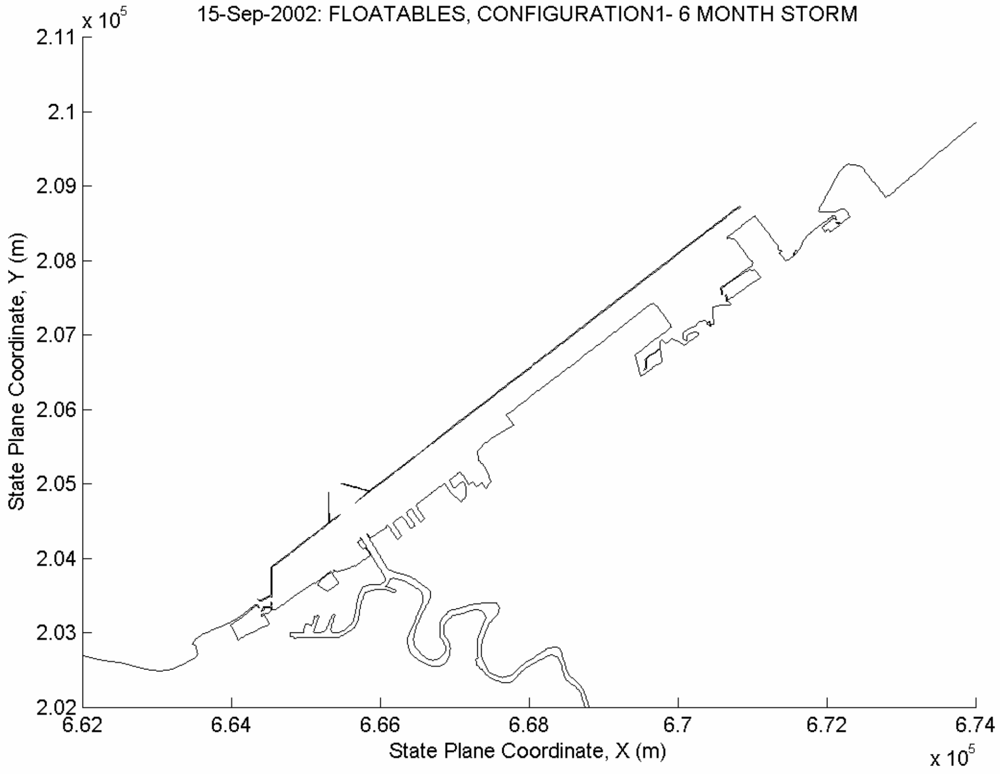
State Plane Coordinate, X (m)
x 10^5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x 10^5
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State Plane Coordinate, Y (m)
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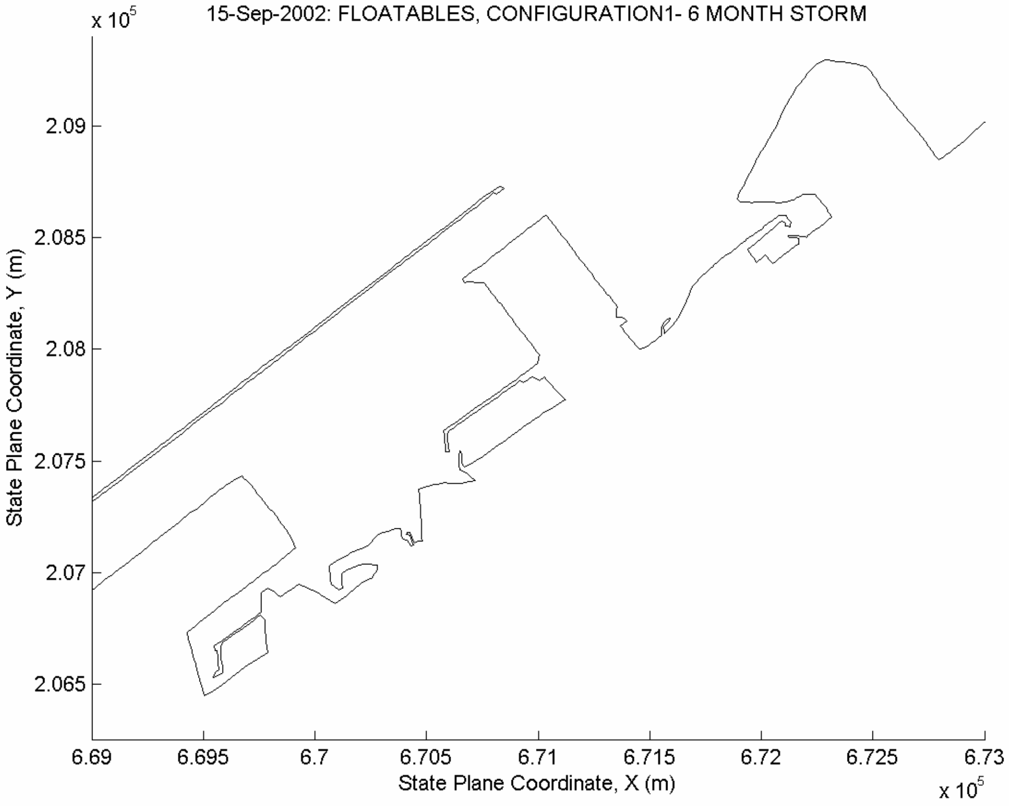
State Plane Coordinate, X (m)
x 10^5


15-Sep-2002: FLOATABLES, CONFIGURATION1- 6 MONTH STORM
x 10^5
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State Plane Coordinate, Y (m)
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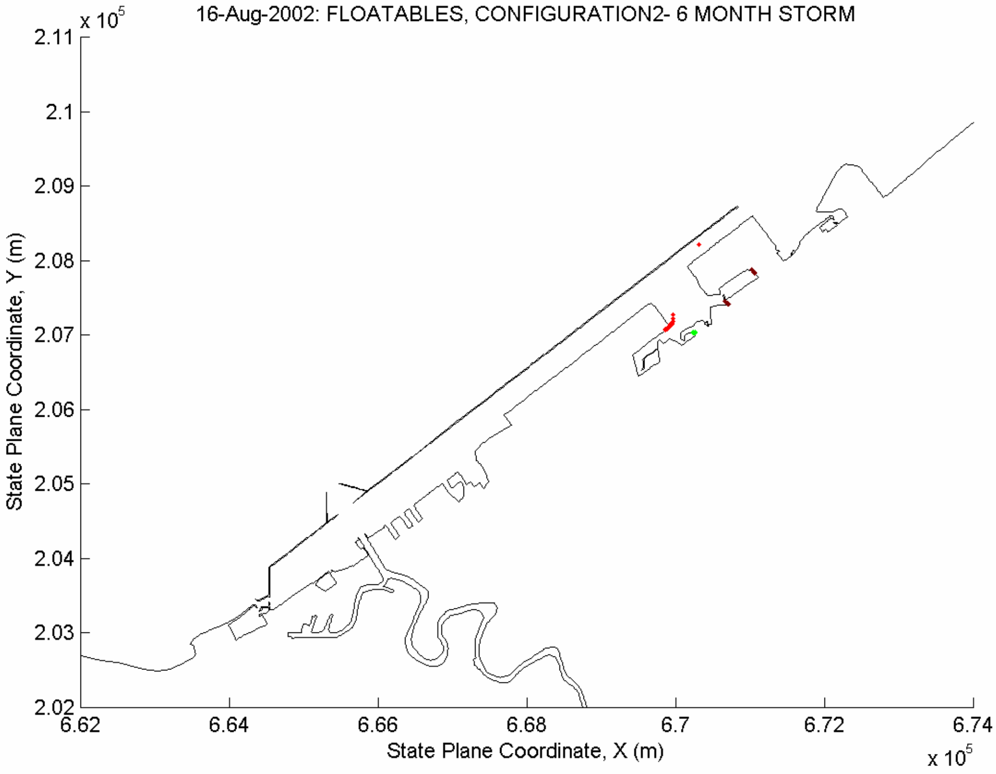
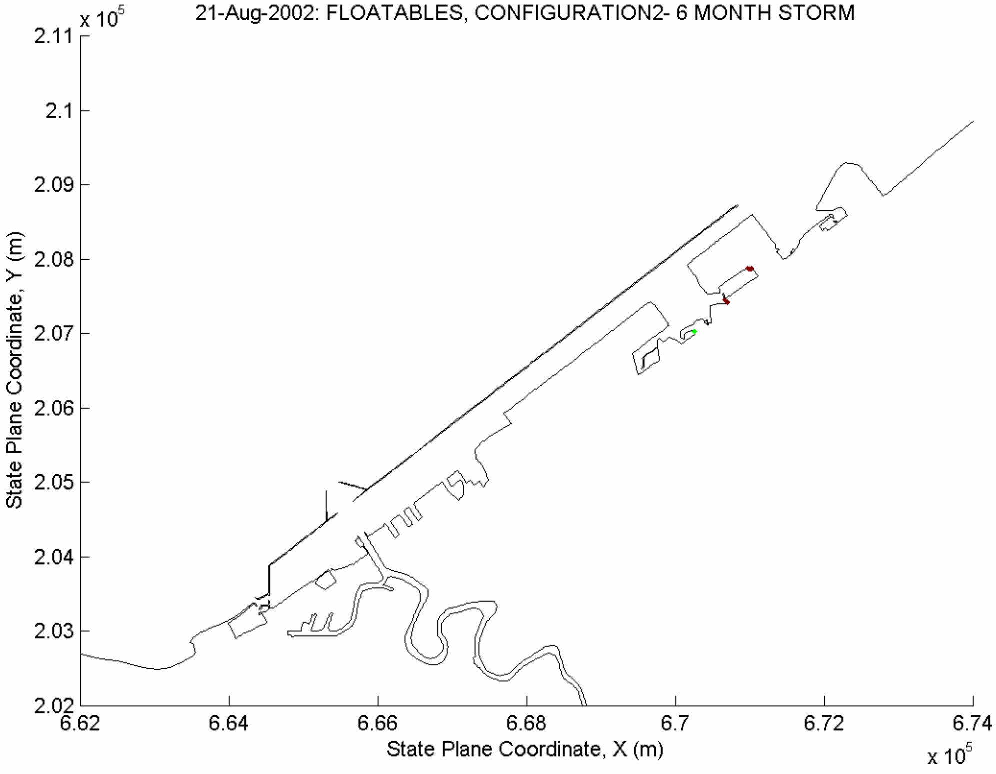
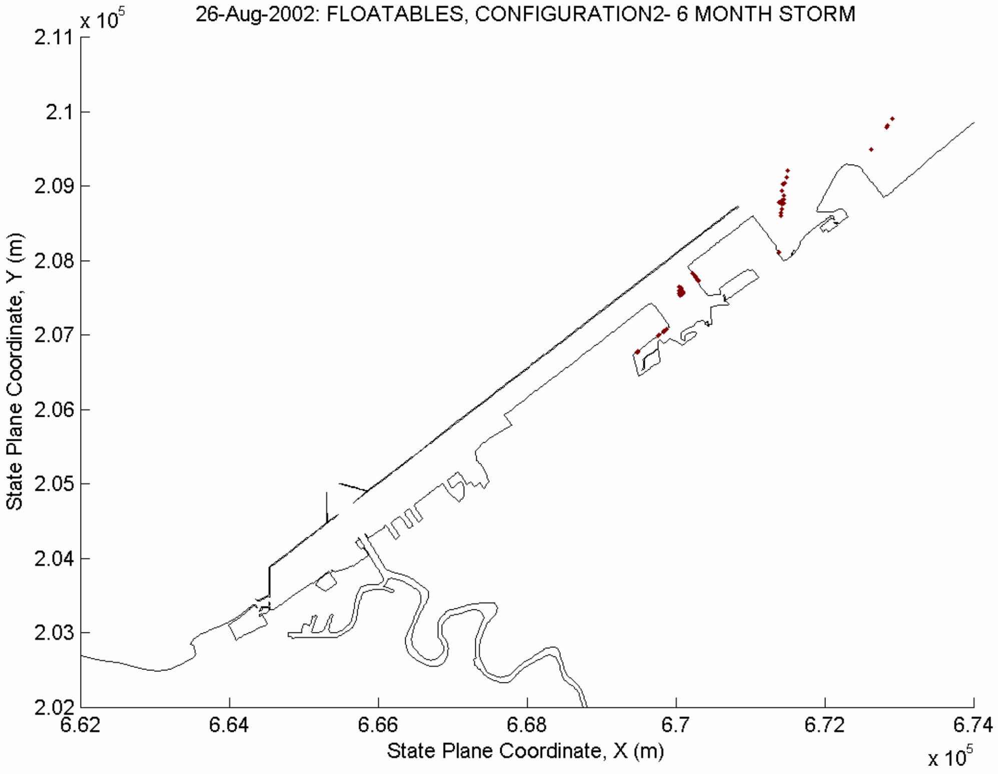
State Plane Coordinate, X (m)
x 10^5



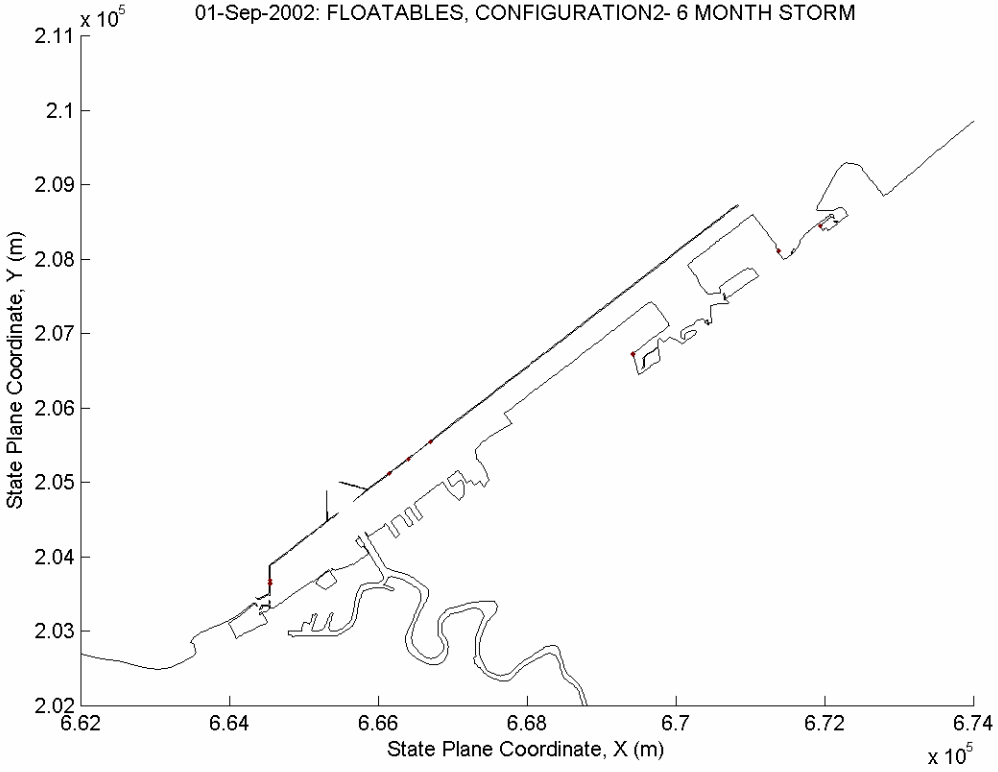
16-Aug-2002: FLOATABLES, CONFIGURATION2- 6 MONTH STORM



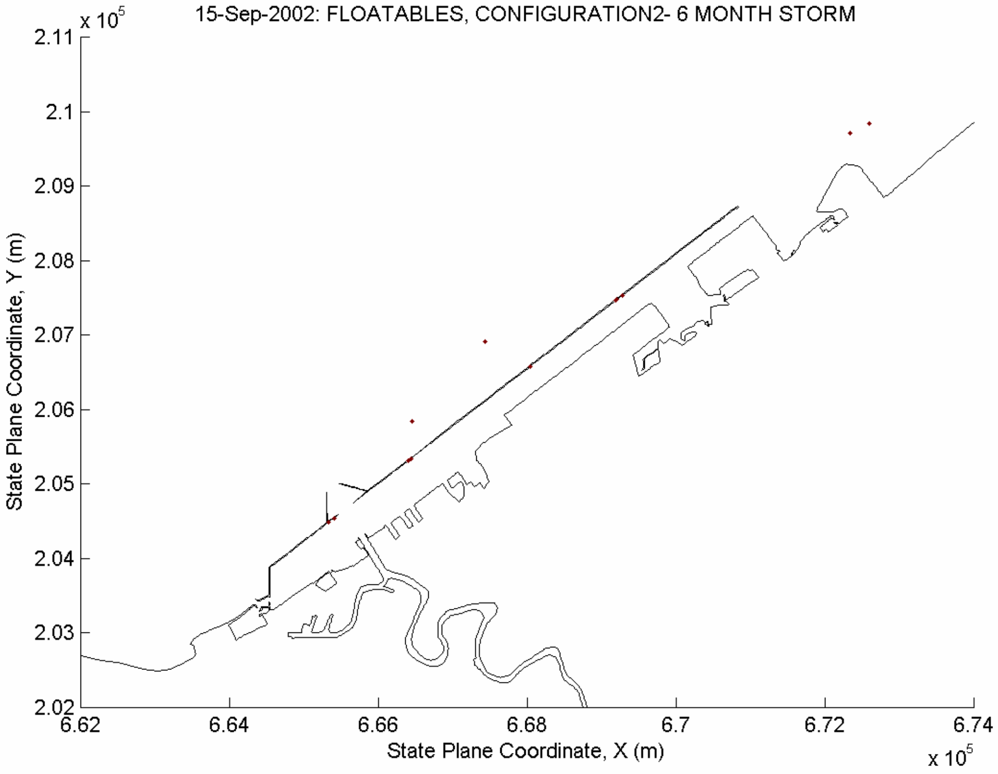
21-Aug-2002: FLOATABLES, CONFIGURATION2- 6 MONTH STORM



26-Aug-2002: FLOATABLES, CONFIGURATION2- 6 MONTH STORM



01-Sep-2002: FLOATABLES, CONFIGURATION2- 6 MONTH STORM



15-Sep-2002: FLOATABLES, CONFIGURATION2- 6 MONTH STORM
x 10^5
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State Plane Coordinate, Y (m)
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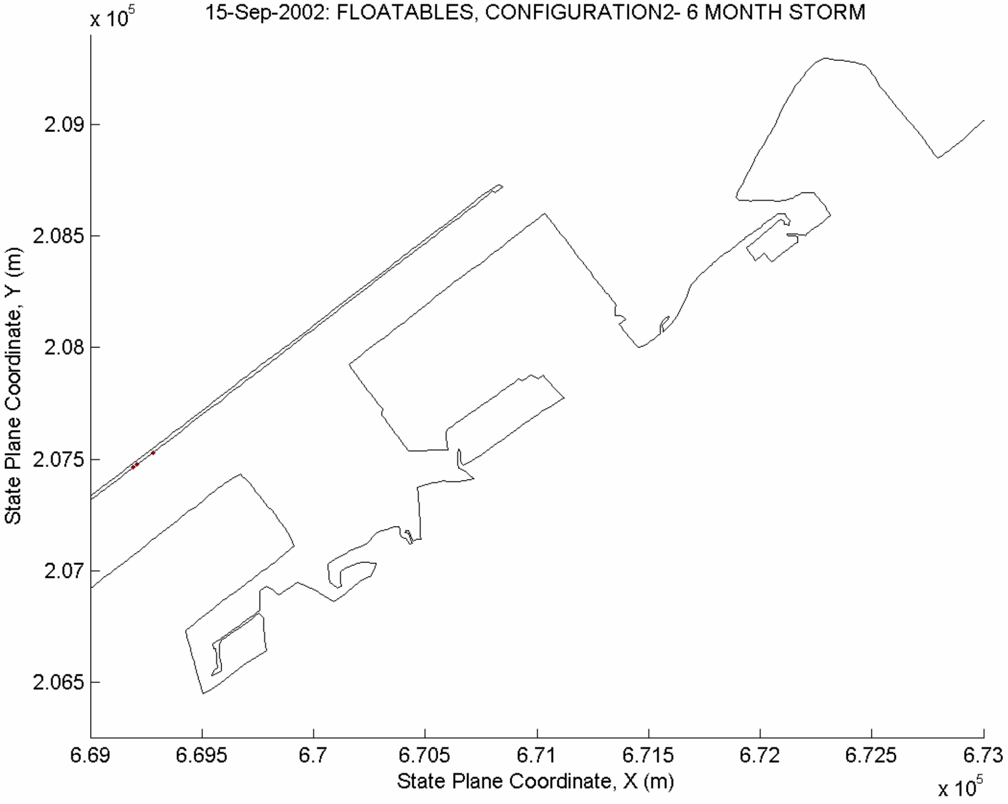
6.74
State Plane Coordinate, X (m)
x 10^5



15-Sep-2002: FLOATABLES, CONFIGURATION2- 6 MONTH STORM
x 10^5
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State Plane Coordinate, Y (m)
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6.72
6.725
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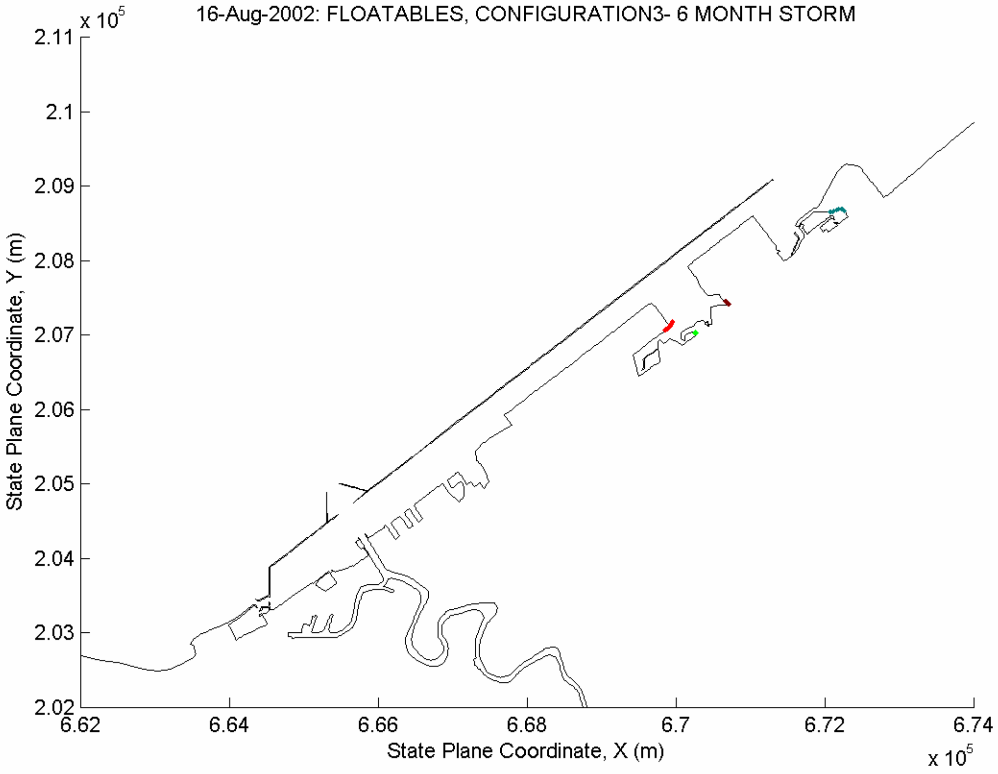
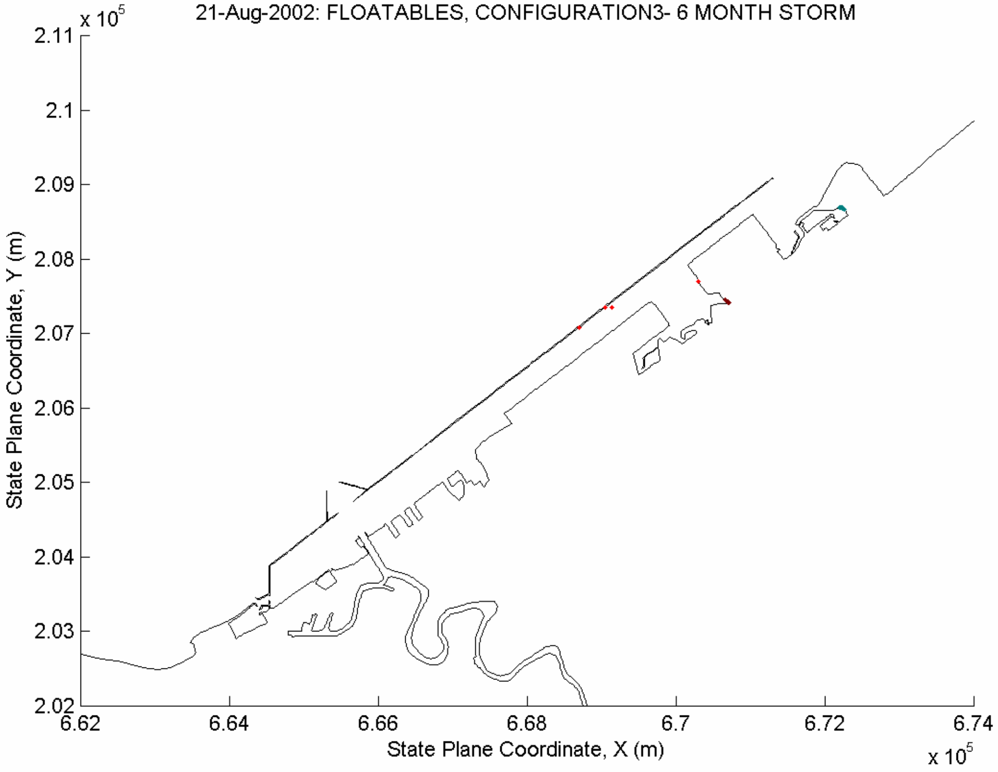
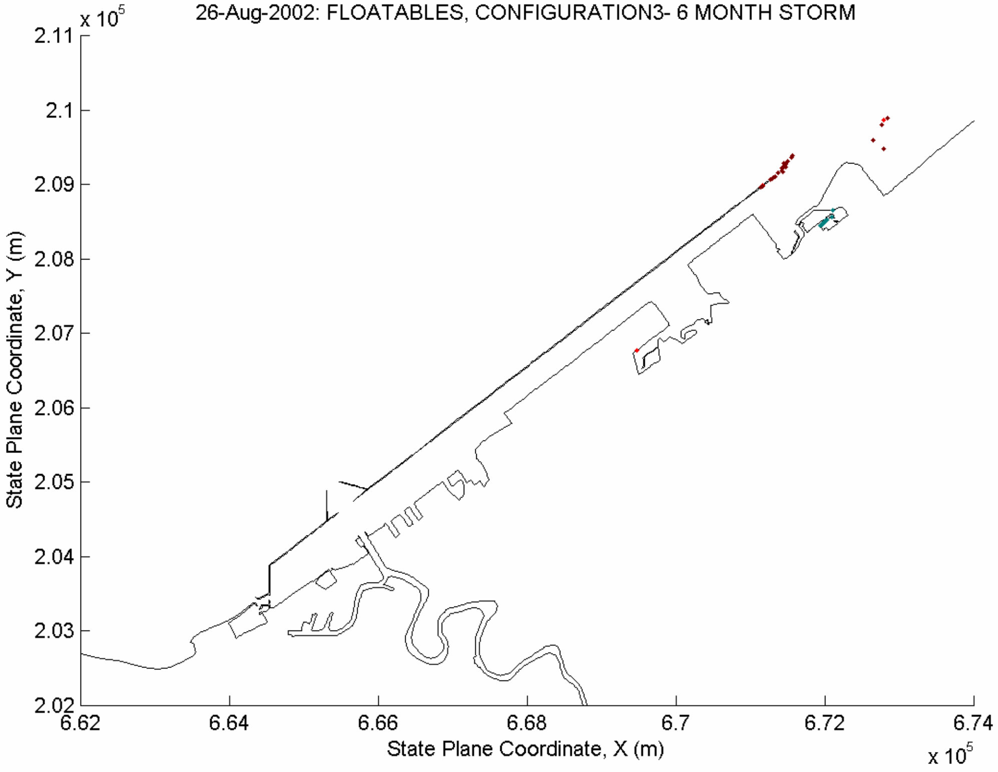
State Plane Coordinate, X (m)
x 10^5

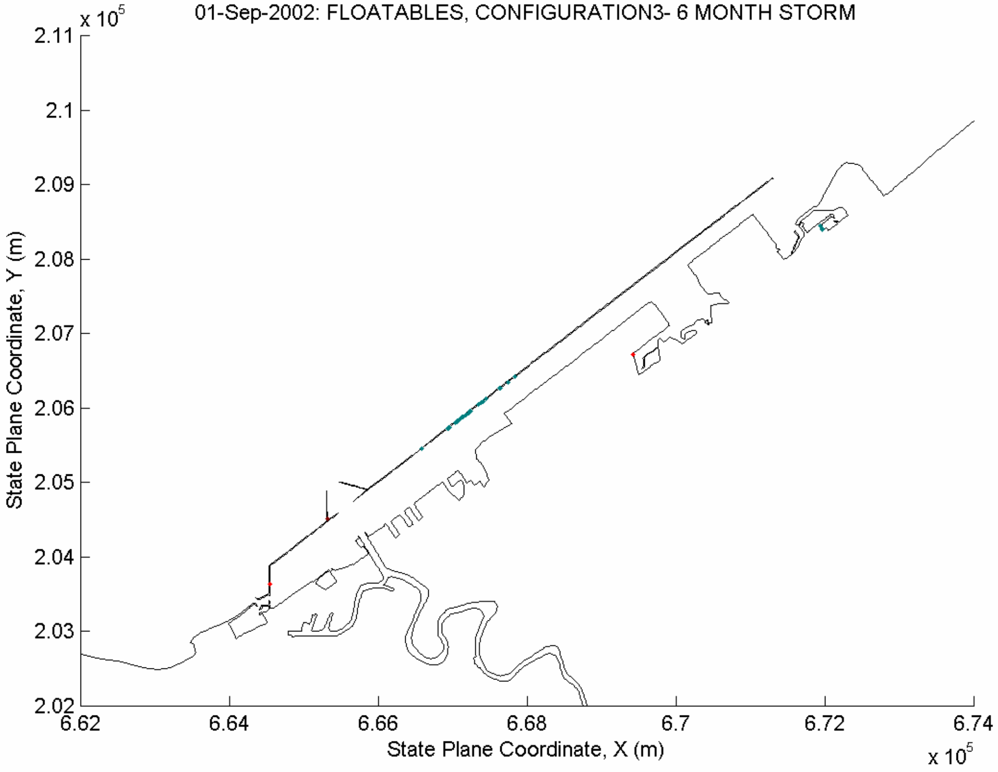


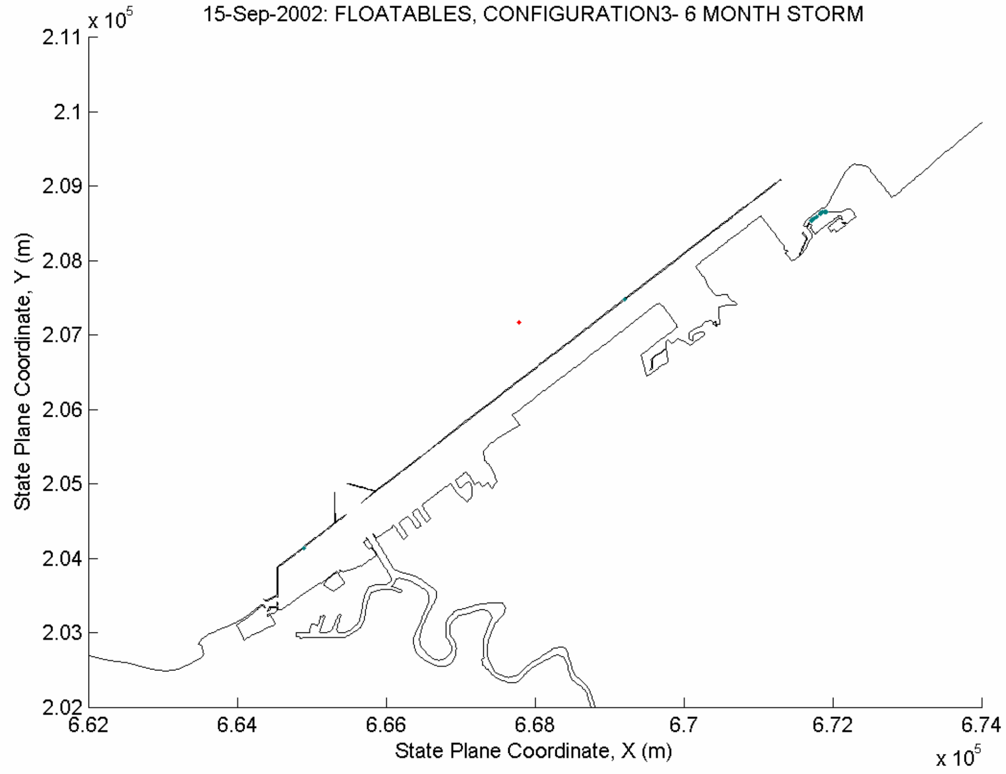
16-Aug-2002: FLOATABLES, CONFIGURATION3- 6 MONTH STORM
x 10^5
2.11
2.1
2.09
2.08
2.07
2.06
2.05
2.04
2.03
2.02
State Plane Coordinate, Y (m)
6.62
6.64
6.66
6.68
6.7
6.72
6.74
State Plane Coordinate, X (m)
x 10^5



21-Aug-2002: FLOATABLES, CONFIGURATION3- 6 MONTH STORM
x 10^5
2.11
2.1
2.09
2.08
2.07
2.06
2.05
2.04
2.03
2.02
State Plane Coordinate, Y (m)
6.62
6.64
6.66
6.68
6.7
6.72
6.74
State Plane Coordinate, X (m)
x 10^5


26-Aug-2002: FLOATABLES, CONFIGURATION3- 6 MONTH STORM


01-Sep-2002: FLOATABLES, CONFIGURATION3- 6 MONTH STORM


15-Sep-2002: FLOATABLES, CONFIGURATION3- 6 MONTH STORM
x 10^5
2.11
2.1
2.09
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2.06
2.05
2.04
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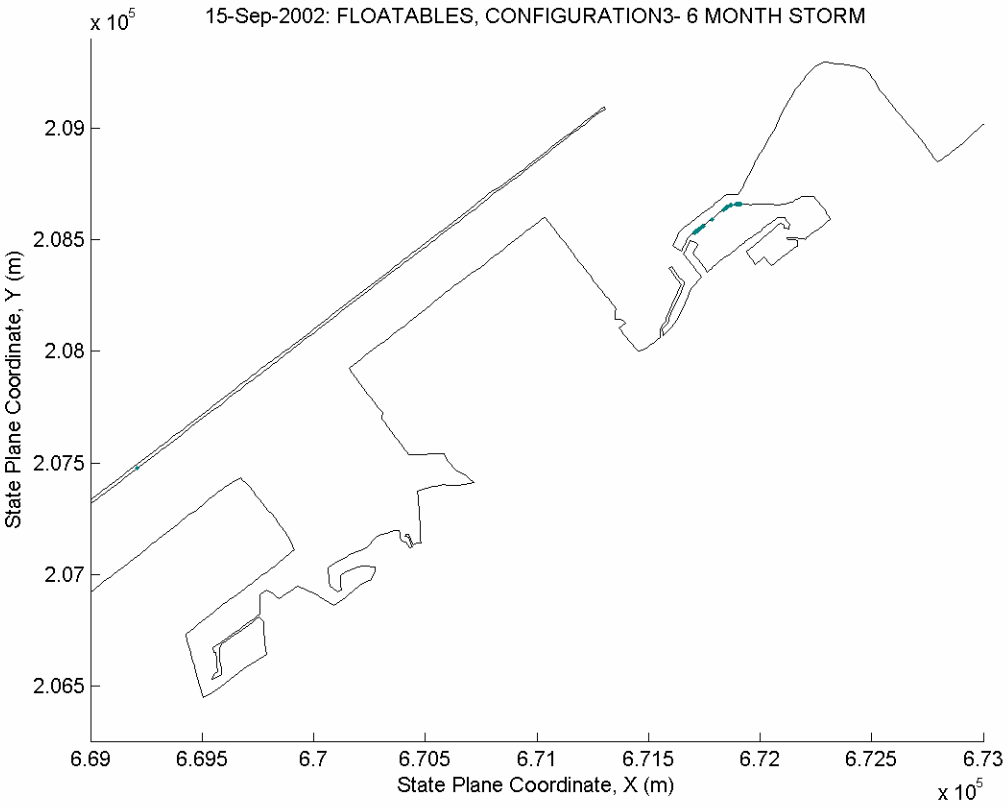
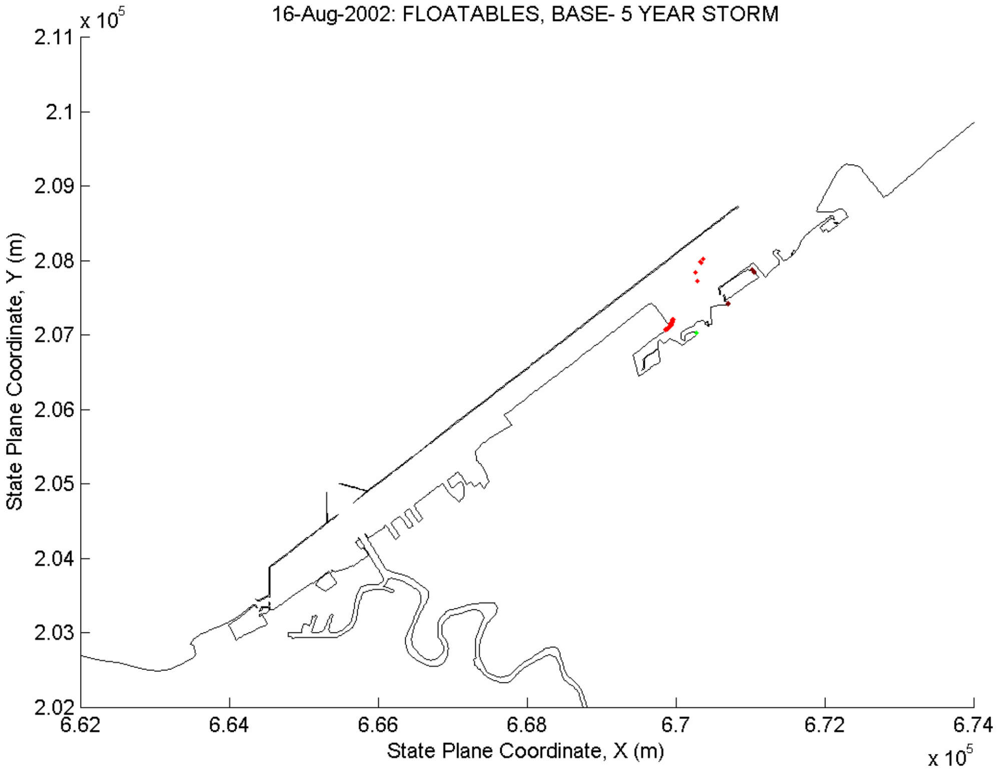
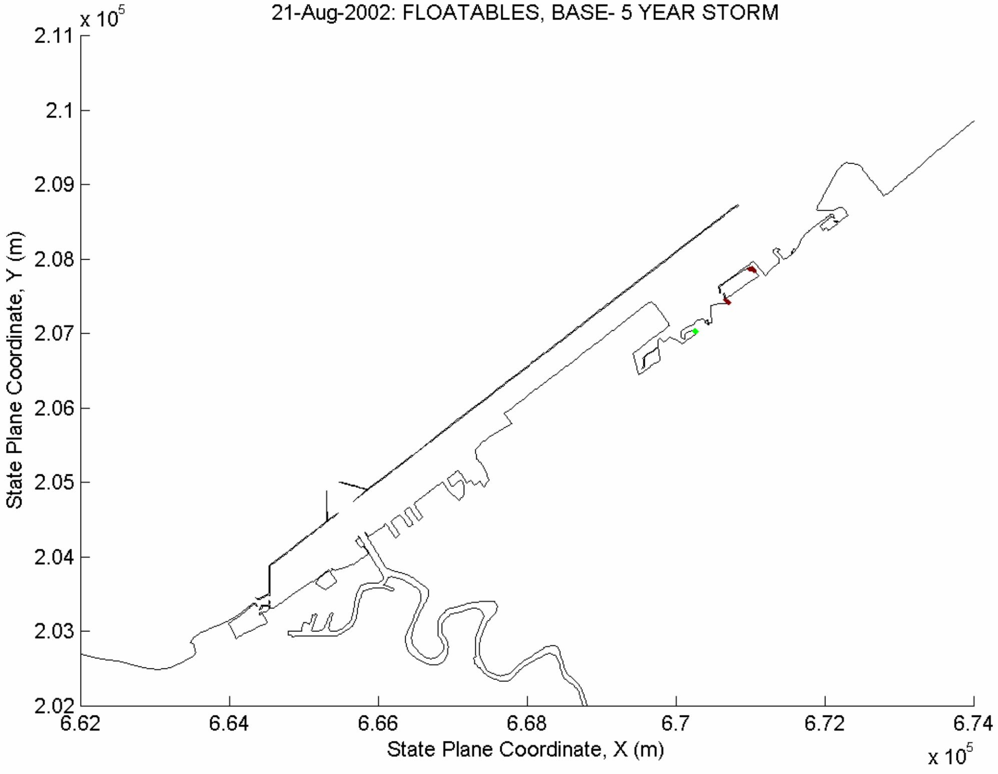
2.02
State Plane Coordinate, Y (m)
6.62
6.64
6.66
6.68
6.7
6.72
6.74
State Plane Coordinate, X (m)
x 10^5

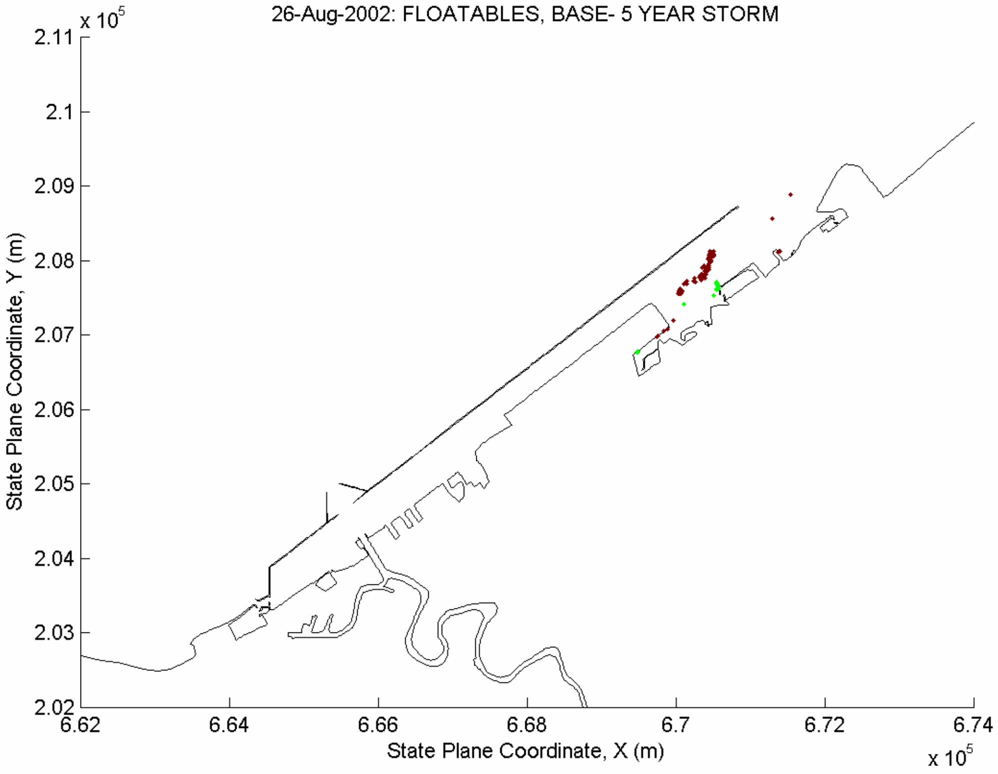

15-Sep-2002: FLOATABLES, CONFIGURATION3- 6 MONTH STORM
x 10^5
2.09
2.085
2.08
2.075
2.07
2.065
State Plane Coordinate, Y (m)
6.69
6.695
6.7
6.705
6.71
6.715
6.72
6.725
6.73
State Plane Coordinate, X (m)
x 10^5



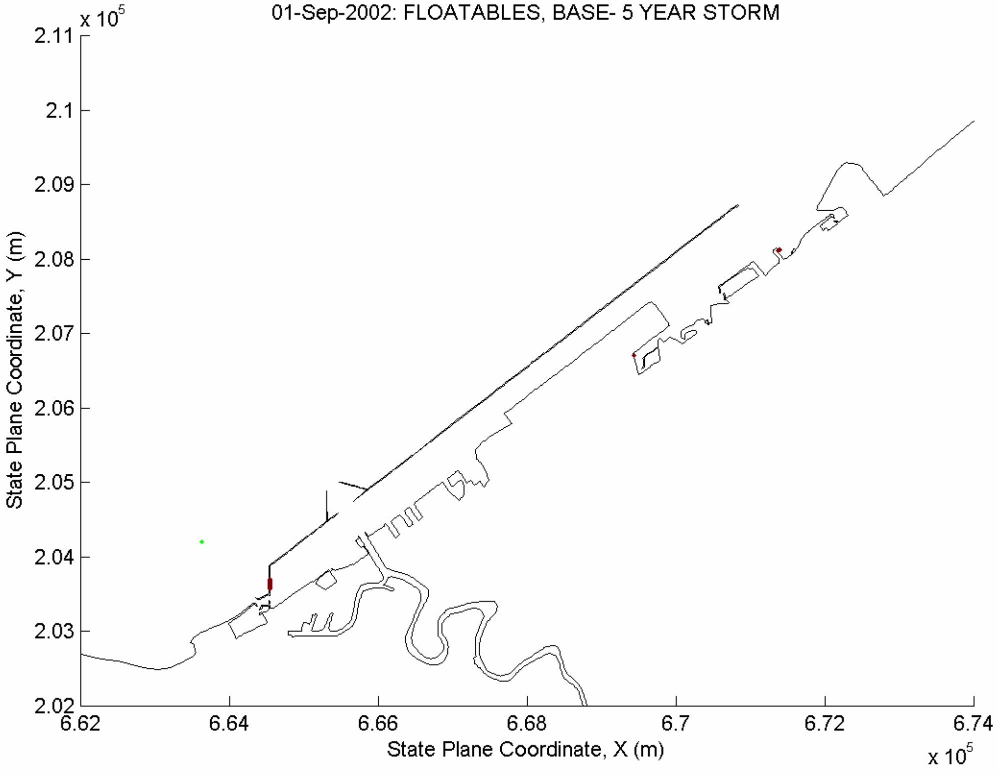
16-Aug-2002: FLOATABLES, BASE- 5 YEAR STORM



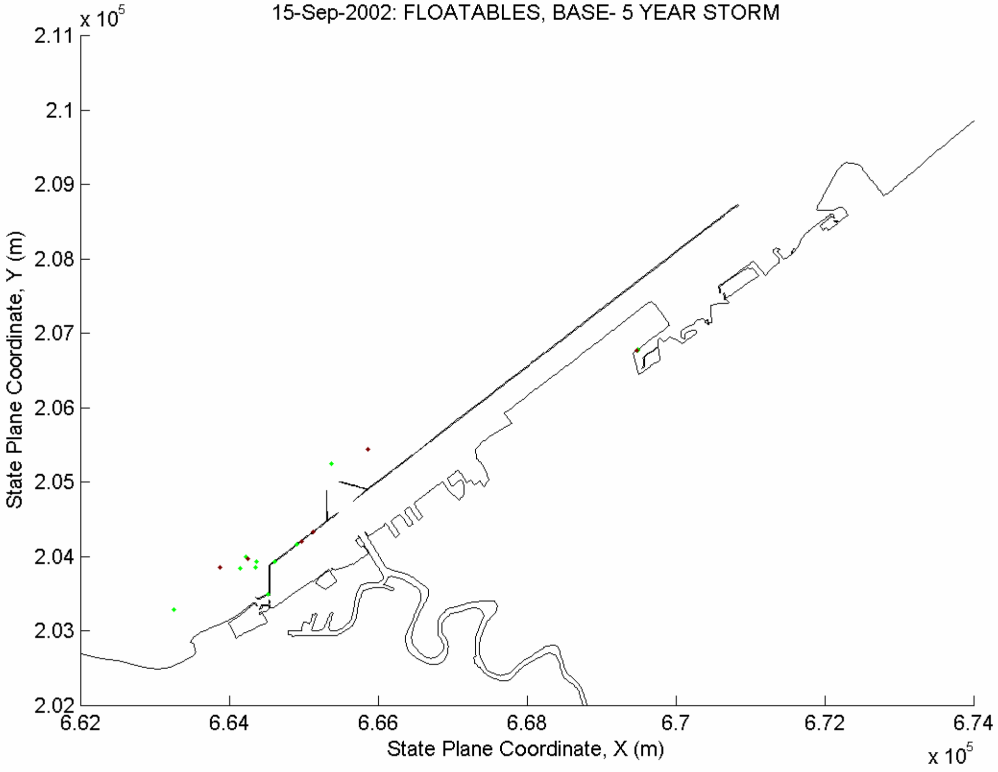
21-Aug-2002: FLOATABLES, BASE- 5 YEAR STORM



26-Aug-2002: FLOATABLES, BASE- 5 YEAR STORM



01-Sep-2002: FLOATABLES, BASE- 5 YEAR STORM


15-Sep-2002: FLOATABLES, BASE- 5 YEAR STORM
x 10^5
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2.02
State Plane Coordinate, Y (m)
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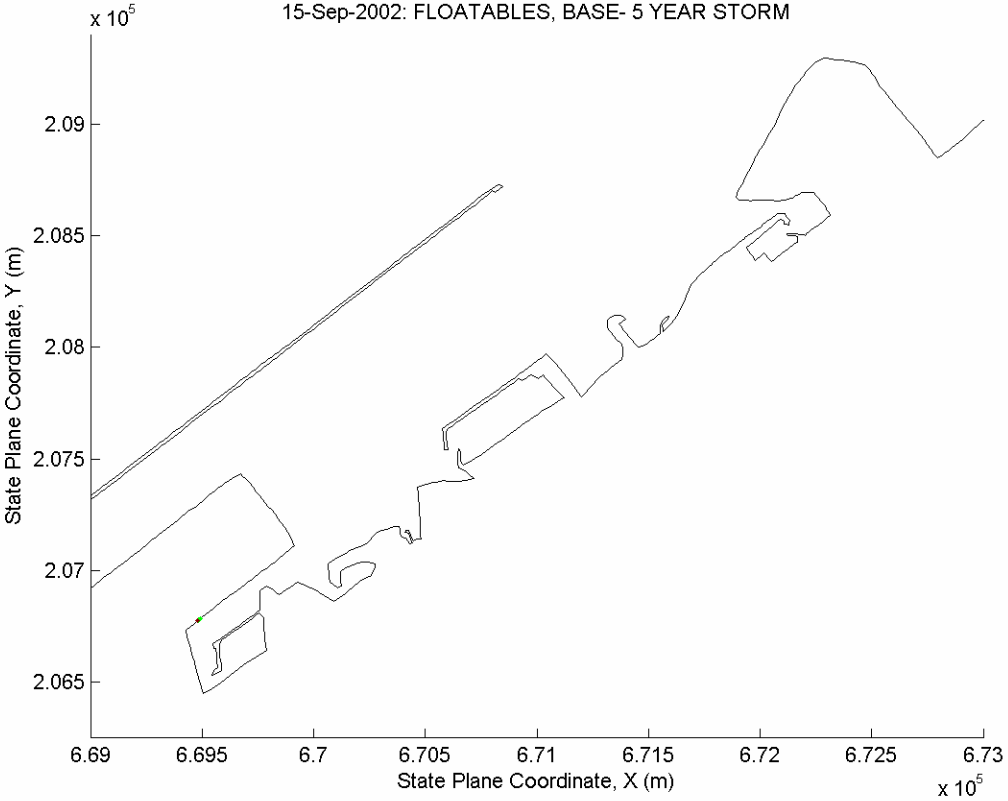
6.72
6.74
State Plane Coordinate, X (m)
x 10^5


15-Sep-2002: FLOATABLES, BASE- 5 YEAR STORM
x 10^5
2.09
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State Plane Coordinate, Y (m)
6.69
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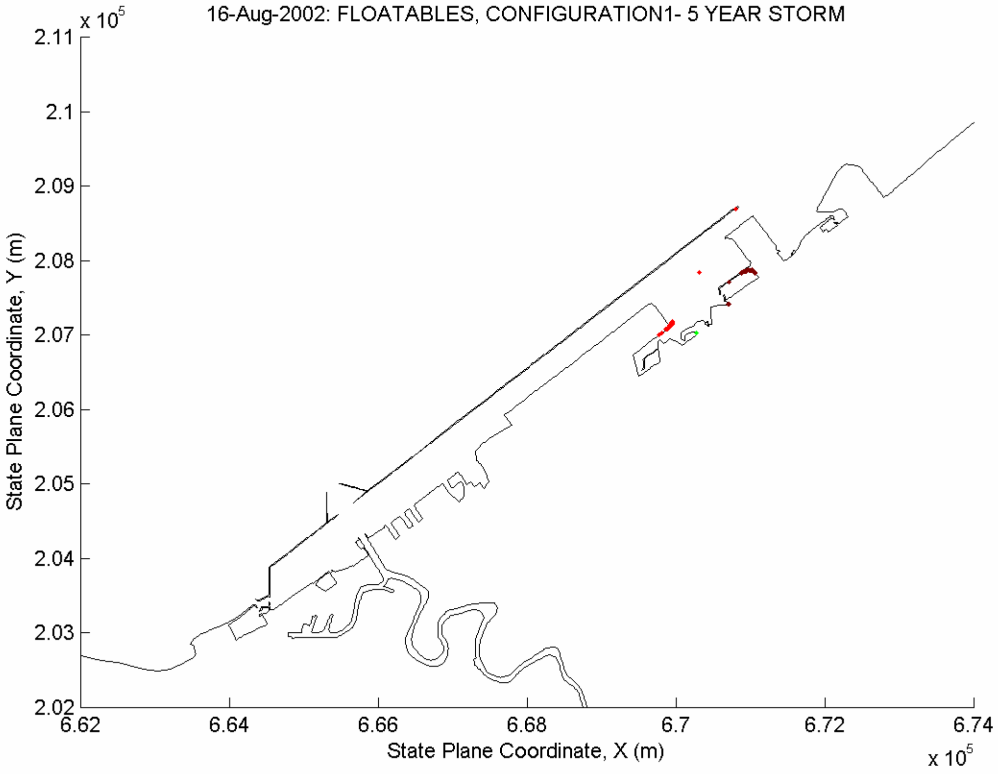
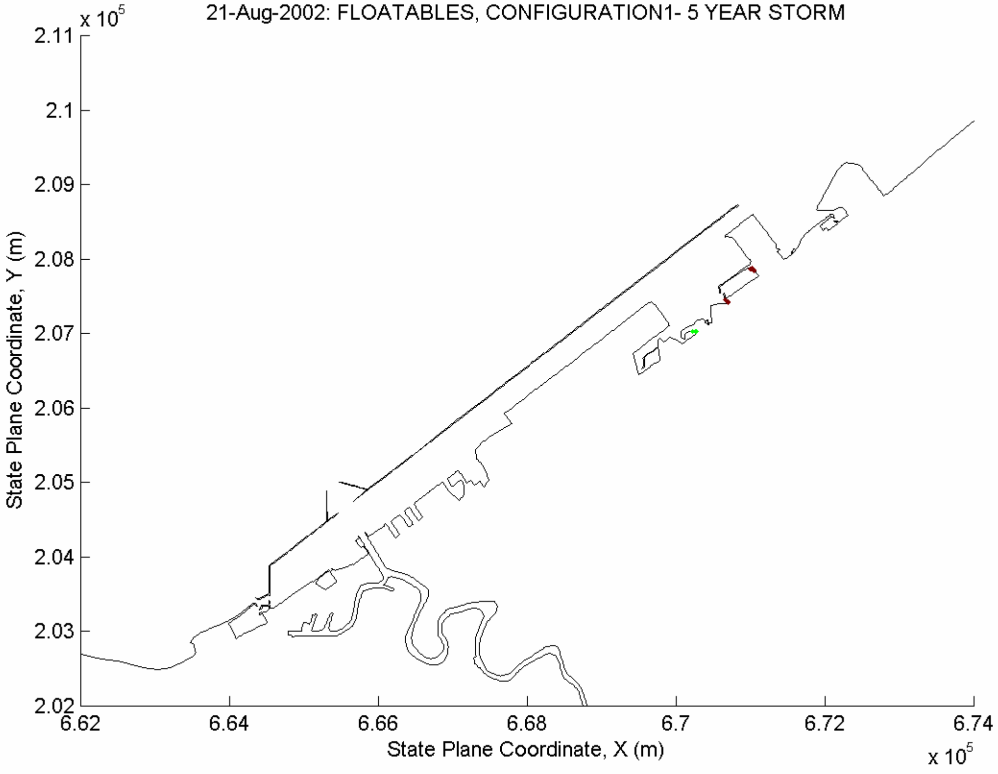
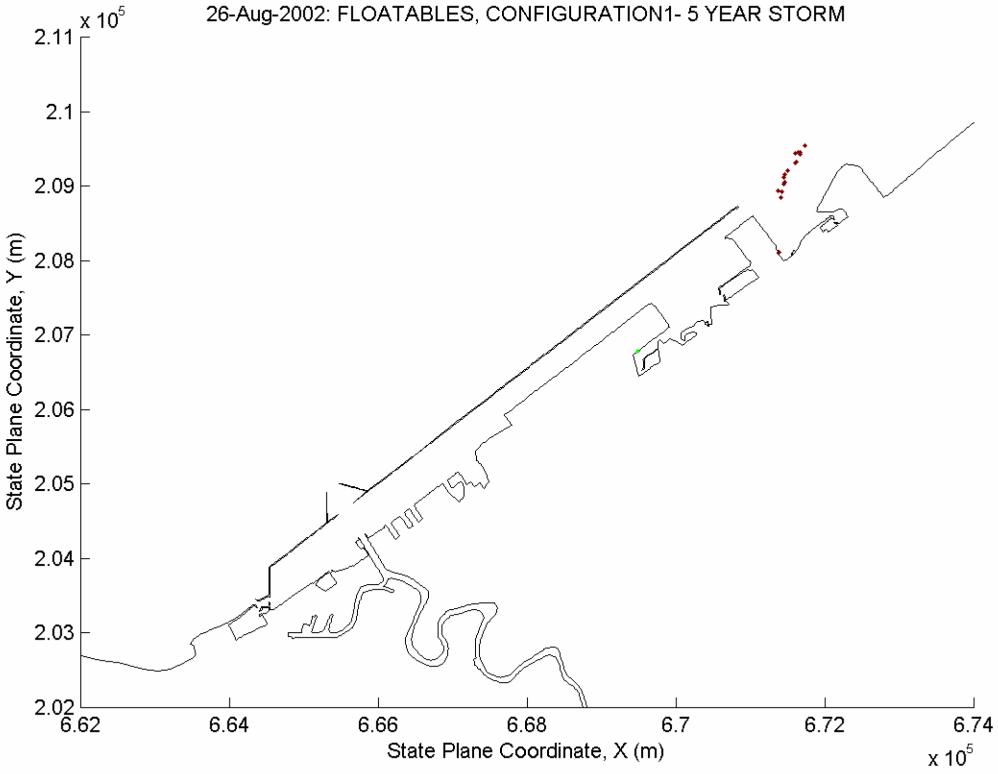
6.725
6.73
State Plane Coordinate, X (m)
x 10^5

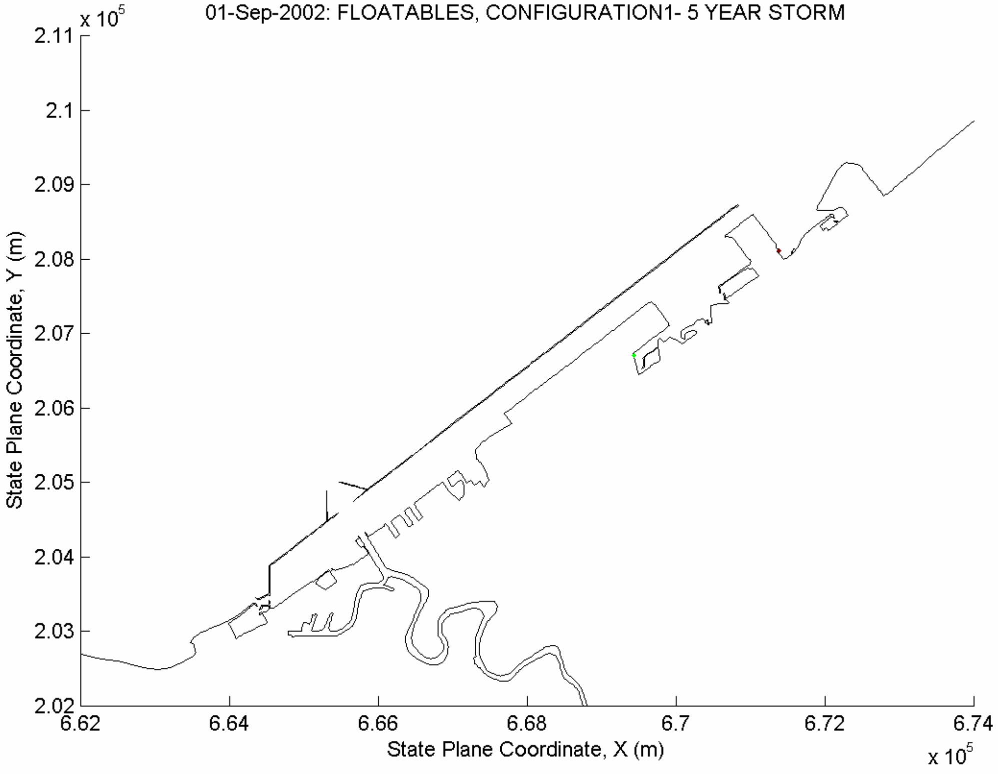


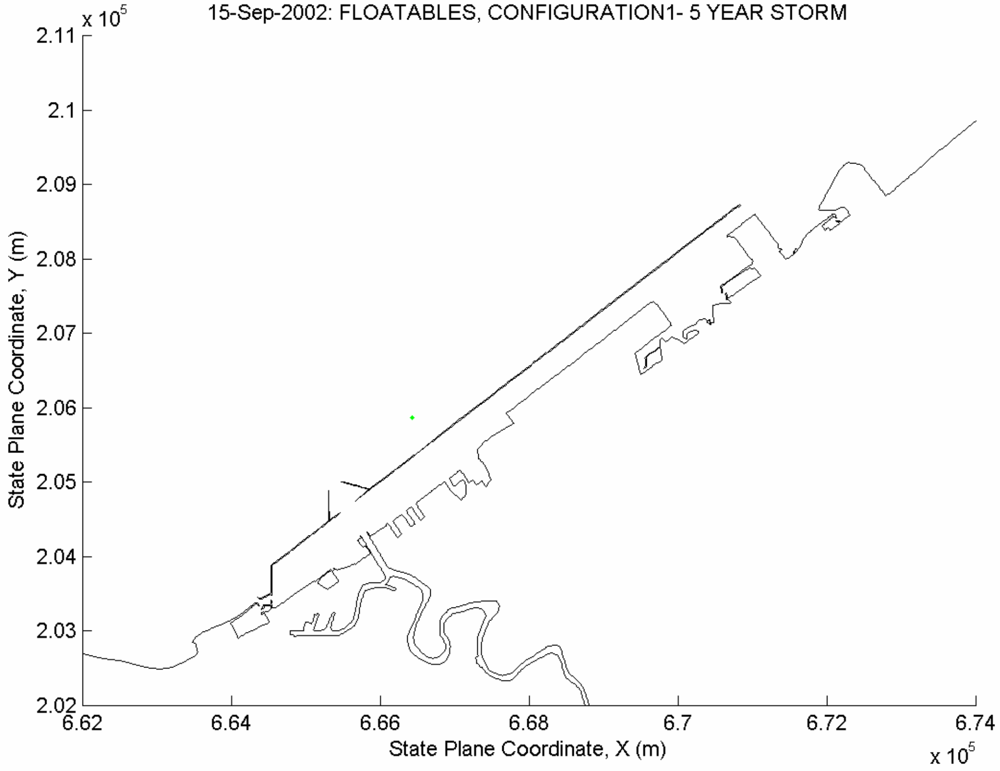
16-Aug-2002: FLOATABLES, CONFIGURATION1- 5 YEAR STORM



21-Aug-2002: FLOATABLES, CONFIGURATION1- 5 YEAR STORM


26-Aug-2002: FLOATABLES, CONFIGURATION1- 5 YEAR STORM


01-Sep-2002: FLOATABLES, CONFIGURATION1- 5 YEAR STORM


15-Sep-2002: FLOATABLES, CONFIGURATION1- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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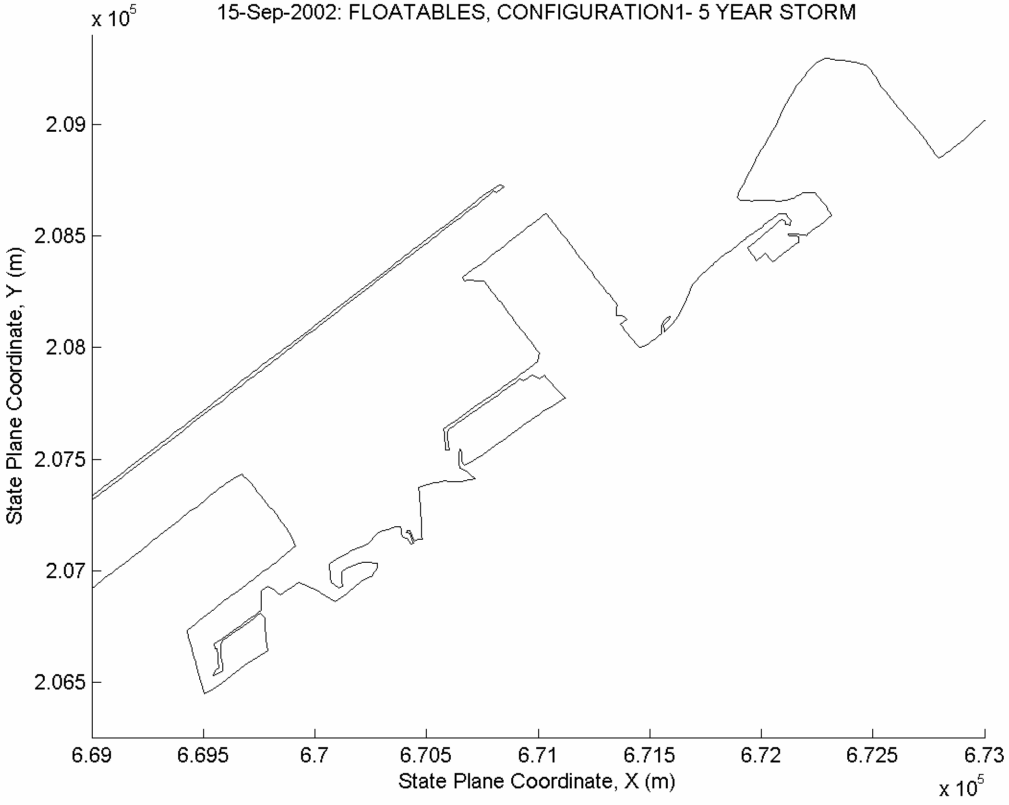
6.74
State Plane Coordinate, X (m)
x 10^5


15-Sep-2002: FLOATABLES, CONFIGURATION1- 5 YEAR STORM
x 10^5
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2.065
State Plane Coordinate, Y (m)
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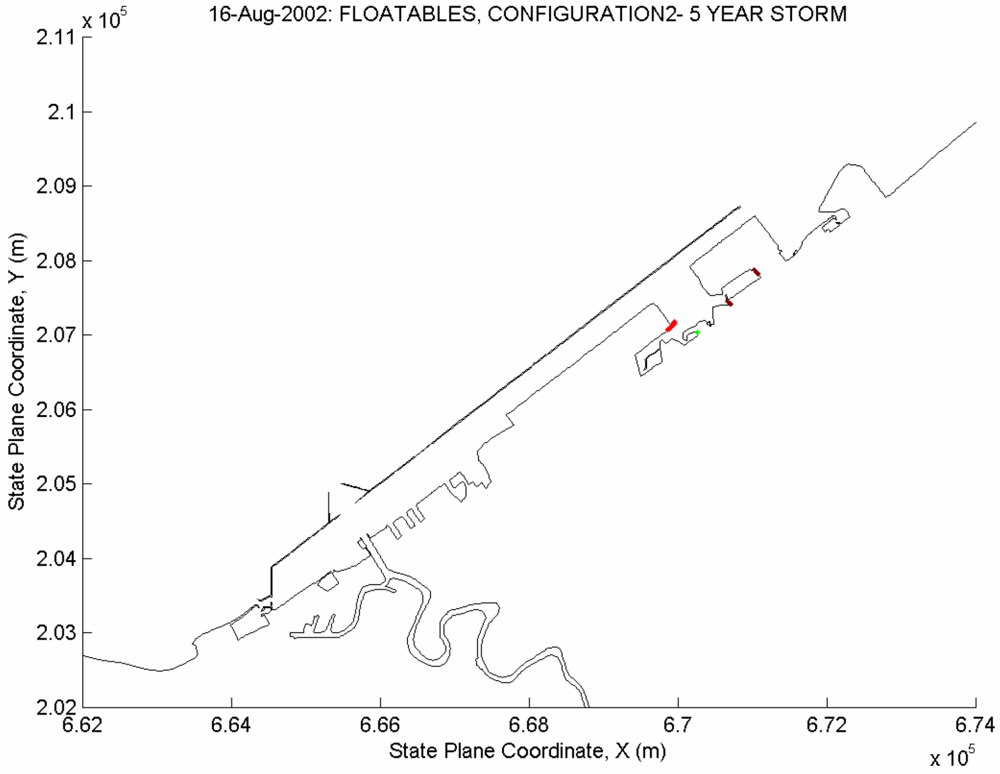
6.725
6.73
State Plane Coordinate, X (m)
x 10^5


16-Aug-2002: FLOATABLES, CONFIGURATION2- 5 YEAR STORM
x 10^5
2.11
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2.05
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State Plane Coordinate, Y (m)
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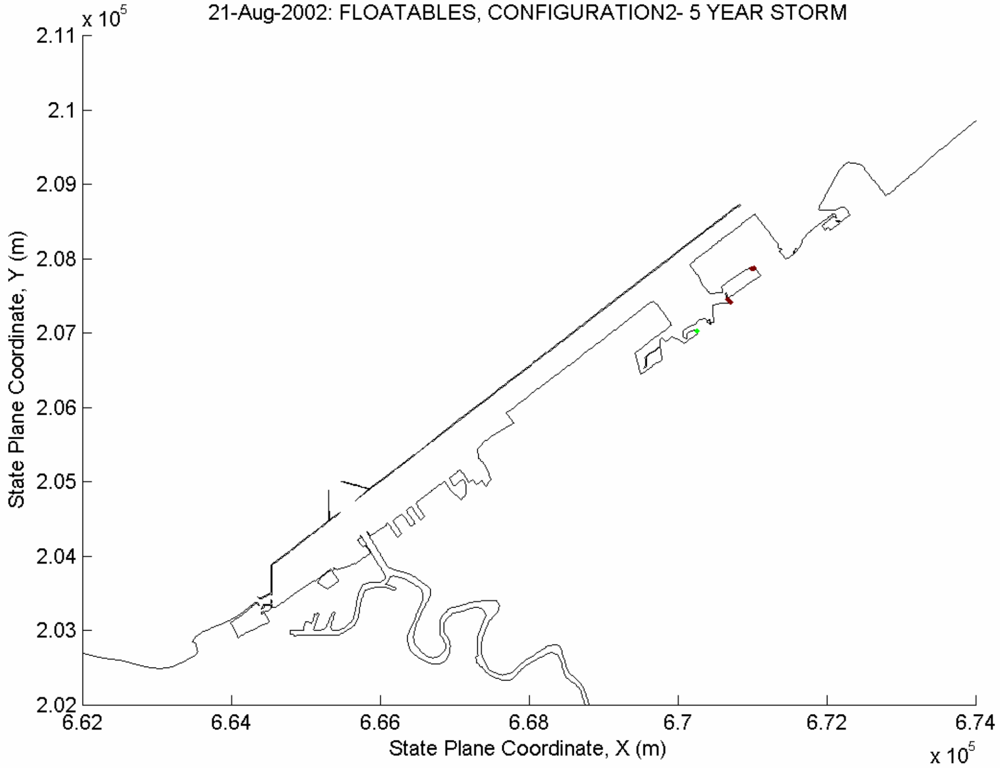
6.72
6.74
State Plane Coordinate, X (m)
x 10^5


21-Aug-2002: FLOATABLES, CONFIGURATION2- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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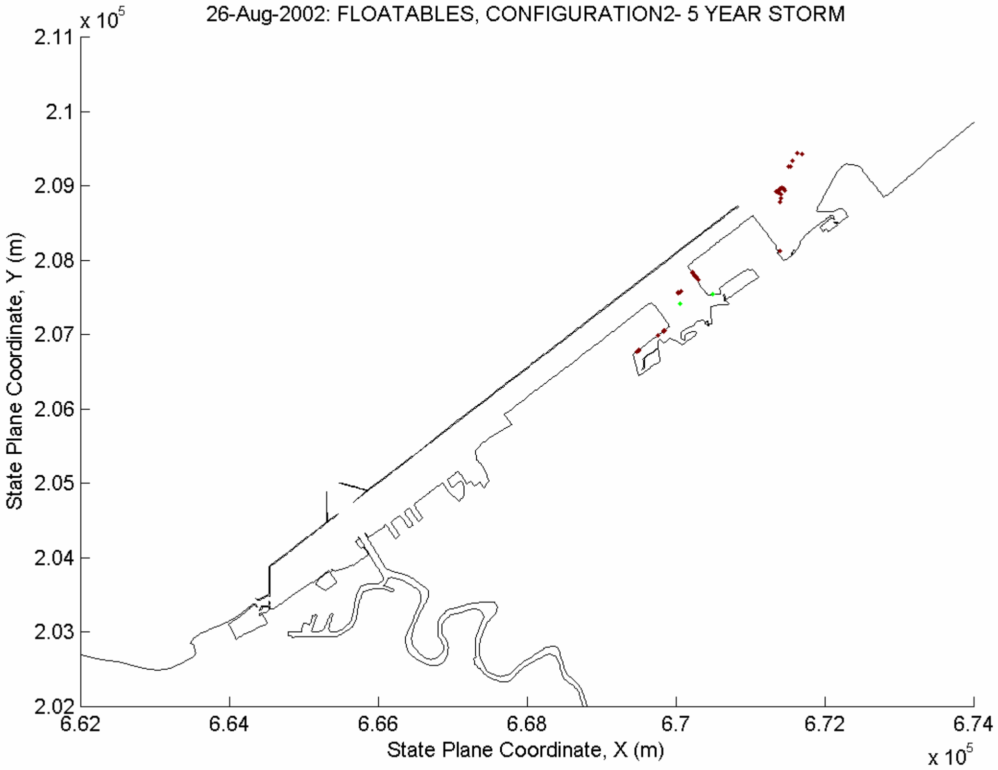
6.74
State Plane Coordinate, X (m)
x 10^5


26-Aug-2002: FLOATABLES, CONFIGURATION2- 5 YEAR STORM
x 10^5
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2.05
2.04
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2.02
State Plane Coordinate, Y (m)
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6.68
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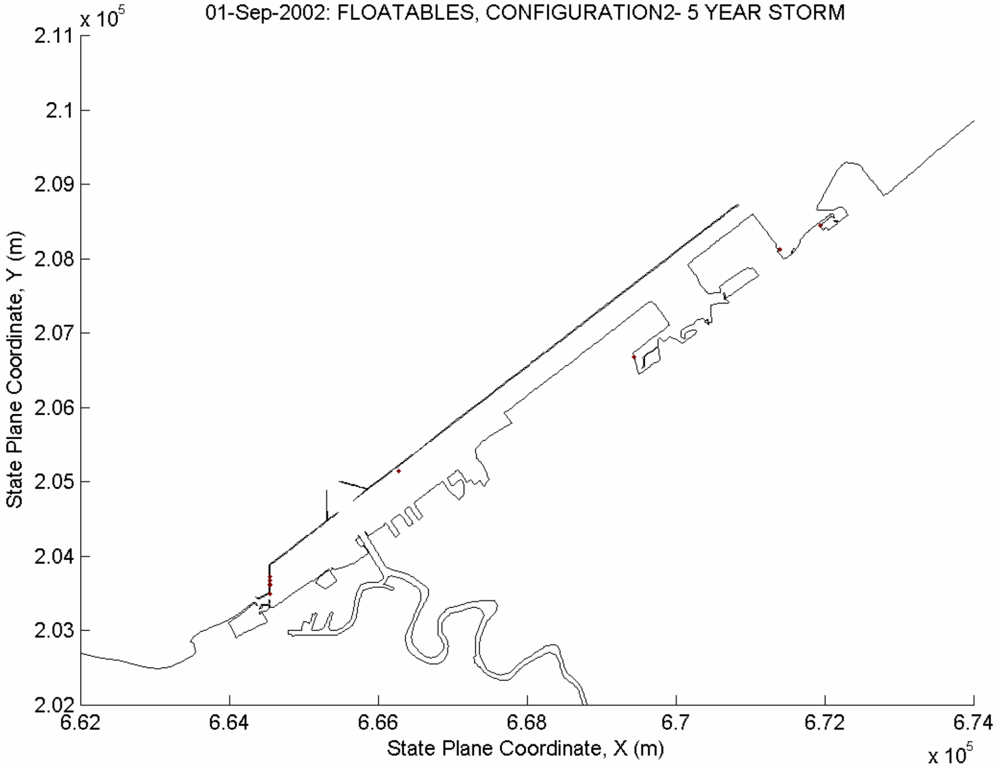
6.72
6.74
State Plane Coordinate, X (m)
x 10^5


01-Sep-2002: FLOATABLES, CONFIGURATION2- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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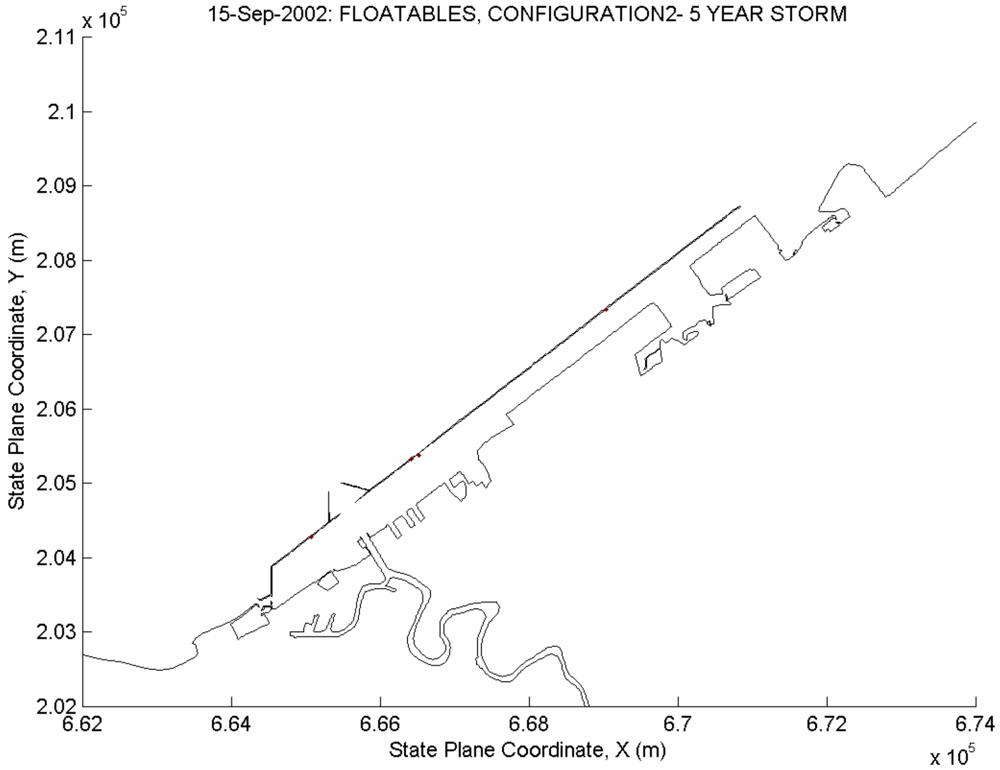
State Plane Coordinate, X (m)
x 10^5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x 10^5
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State Plane Coordinate, Y (m)
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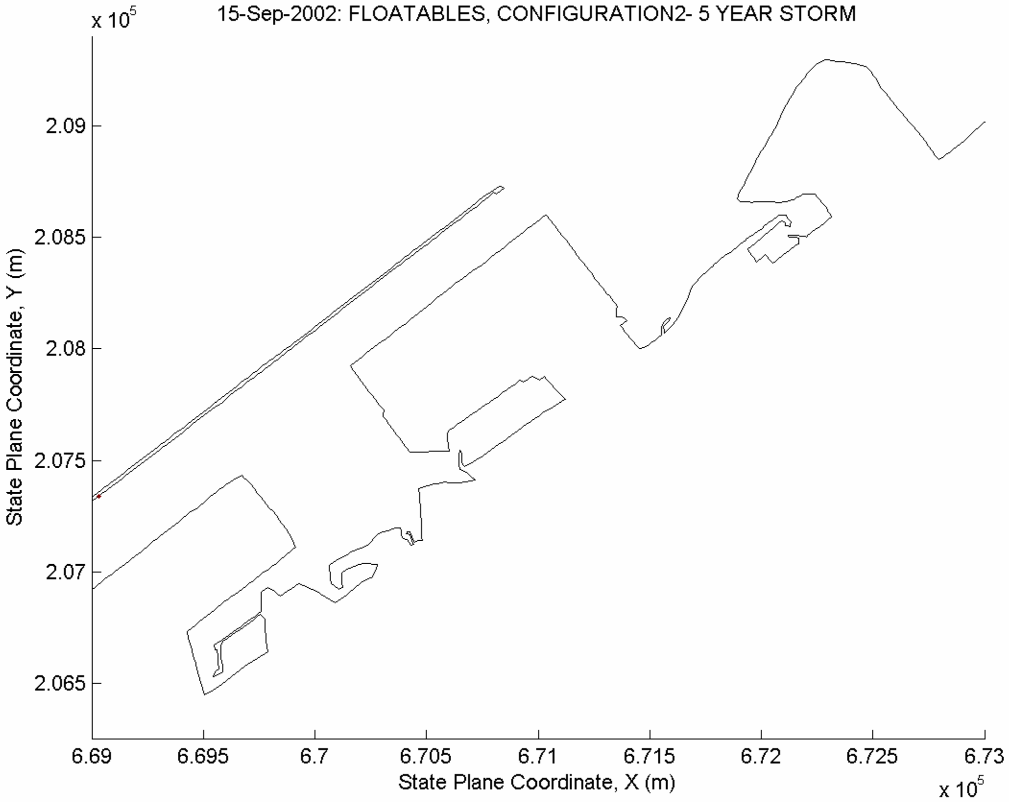
State Plane Coordinate, X (m)
x 10^5


15-Sep-2002: FLOATABLES, CONFIGURATION2- 5 YEAR STORM
x 10^5
2.09
2.085
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2.065
State Plane Coordinate, Y (m)
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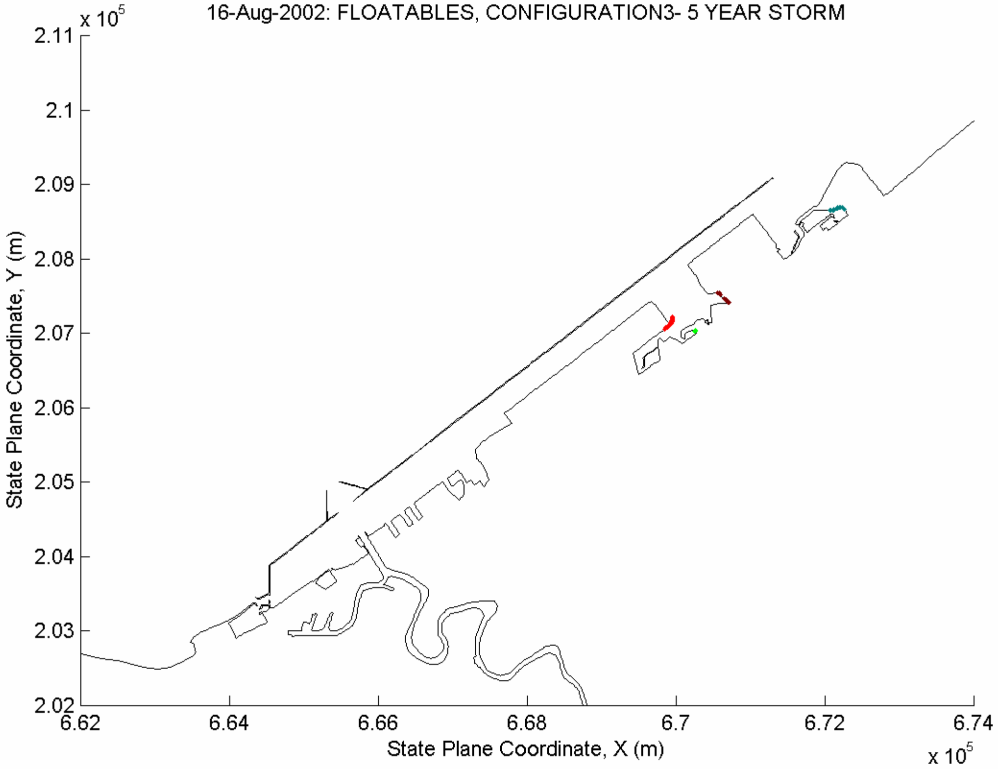
6.72
6.725
6.73
State Plane Coordinate, X (m)
x 10^5


16-Aug-2002: FLOATABLES, CONFIGURATION3- 5 YEAR STORM
x 10^5
2.11
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2.05
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2.02
State Plane Coordinate, Y (m)
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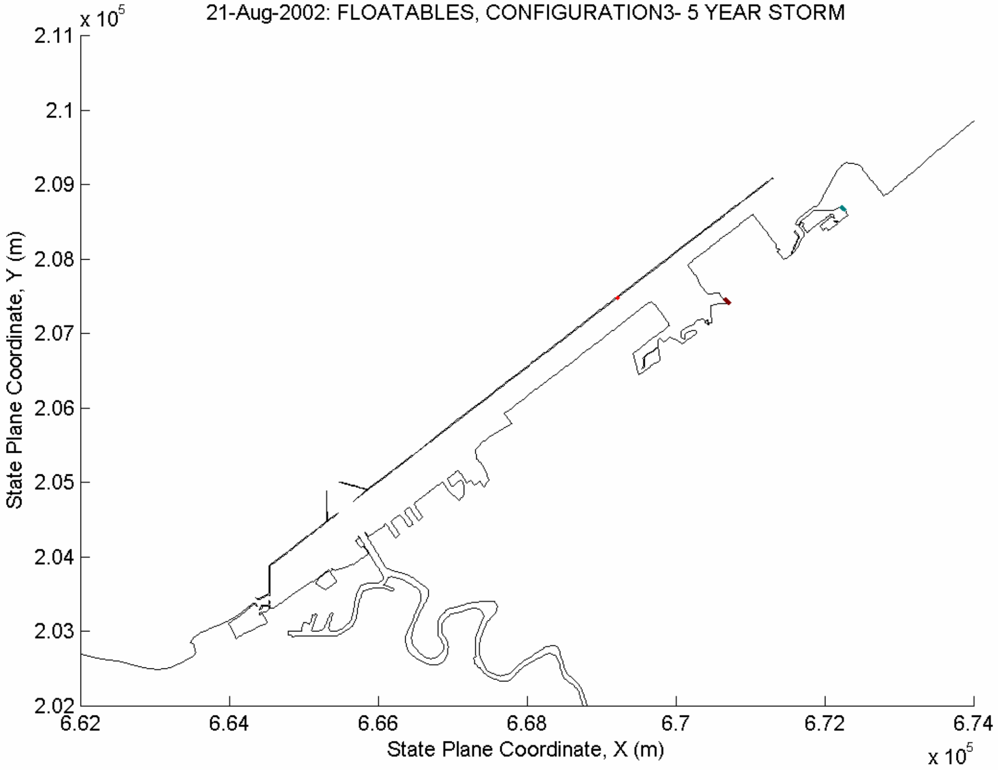
State Plane Coordinate, X (m)
x 10^5


21-Aug-2002: FLOATABLES, CONFIGURATION3- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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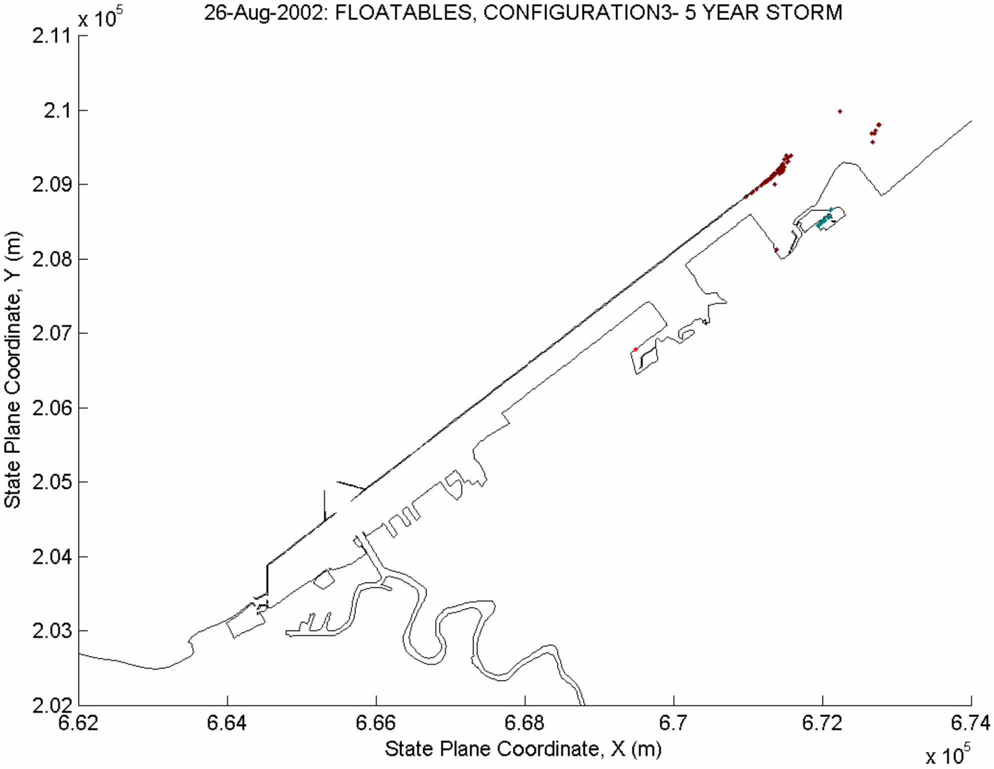
State Plane Coordinate, X (m)
x 10^5


26-Aug-2002: FLOATABLES, CONFIGURATION3- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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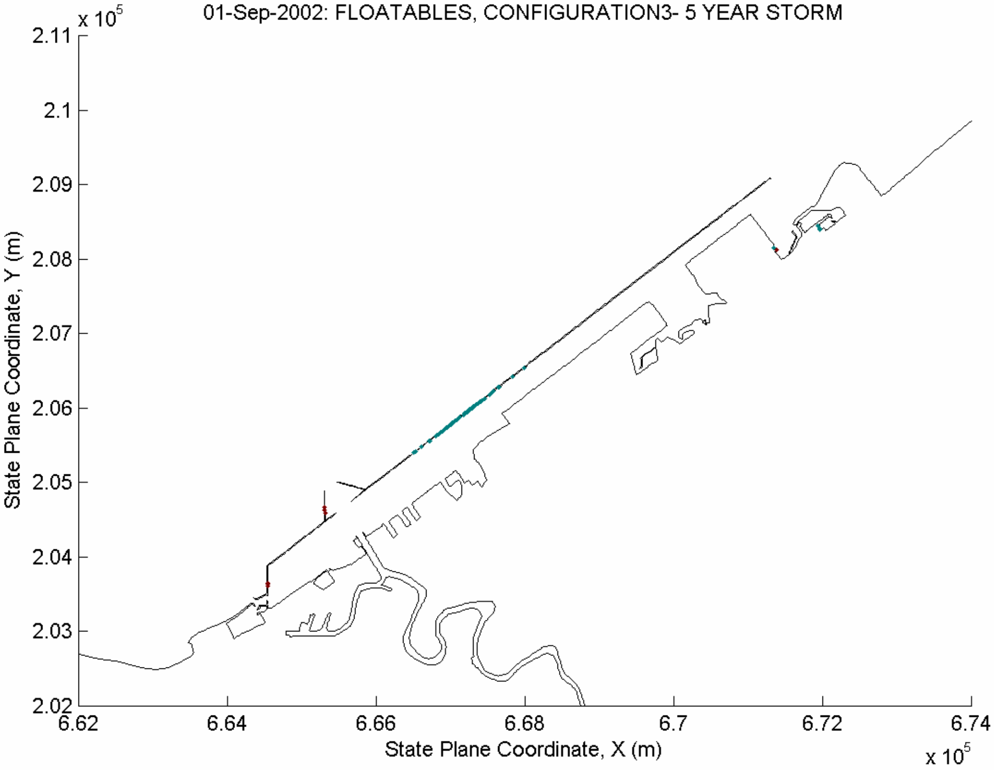
State Plane Coordinate, X (m)
x 10^5


01-Sep-2002: FLOATABLES, CONFIGURATION3- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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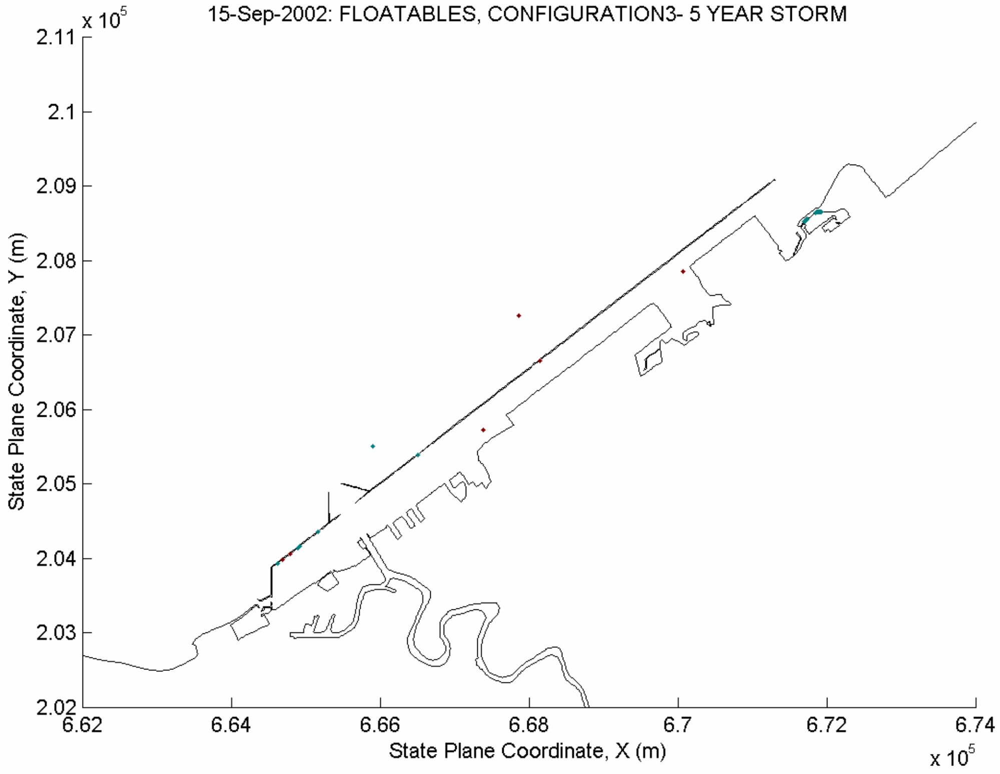
State Plane Coordinate, X (m)
x 10^5


15-Sep-2002: FLOATABLES, CONFIGURATION3- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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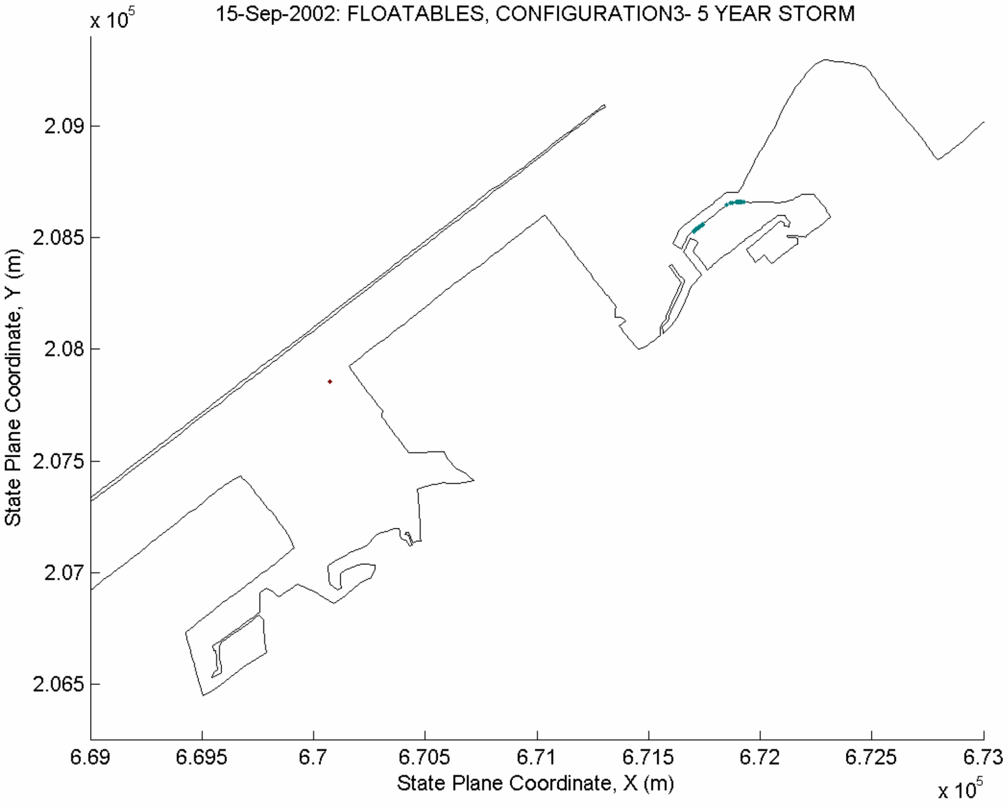
6.74
State Plane Coordinate, X (m)
x 10^5


15-Sep-2002: FLOATABLES, CONFIGURATION3- 5 YEAR STORM
x 10^5
2.09
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State Plane Coordinate, Y (m)
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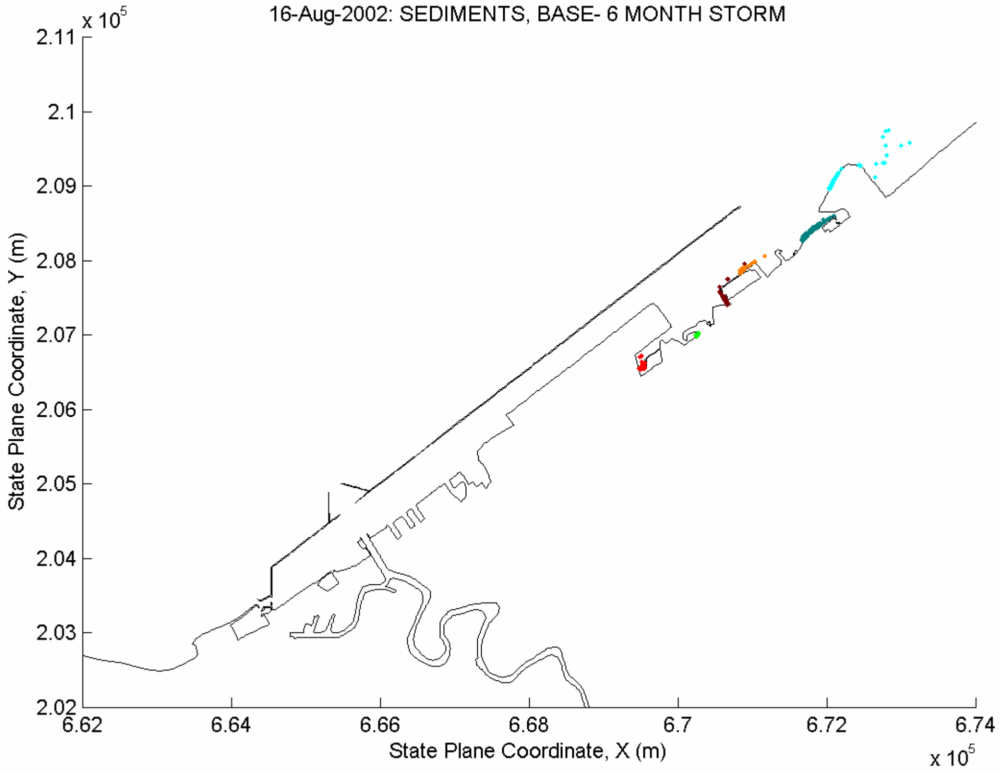
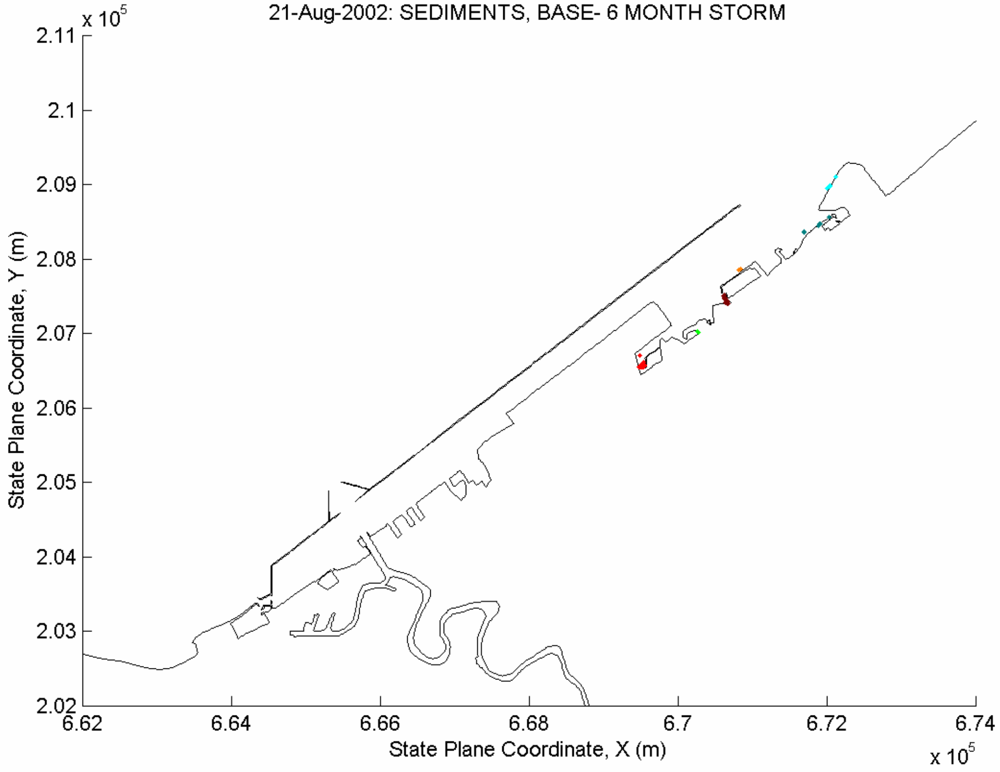
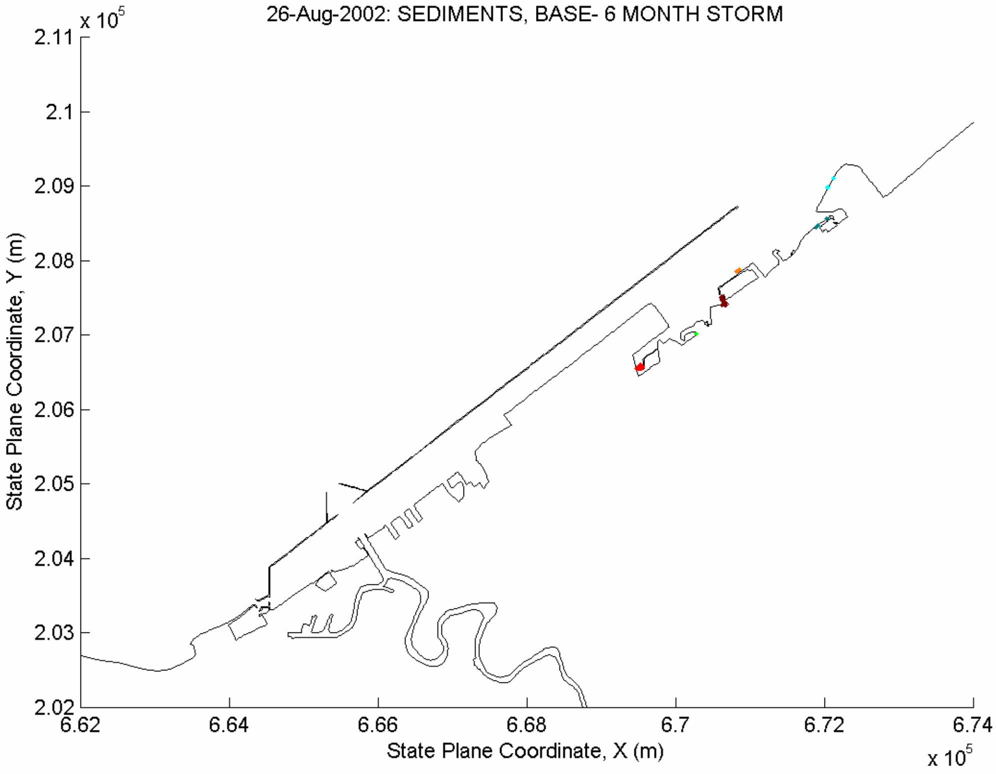
6.725
6.73
State Plane Coordinate, X (m)
x 10^5



16-Aug-2002: SEDIMENTS, BASE- 6 MONTH STORM



21-Aug-2002: SEDIMENTS, BASE- 6 MONTH STORM


26-Aug-2002: SEDIMENTS, BASE- 6 MONTH STORM
x 10^5
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State Plane Coordinate, Y (m)
6.62
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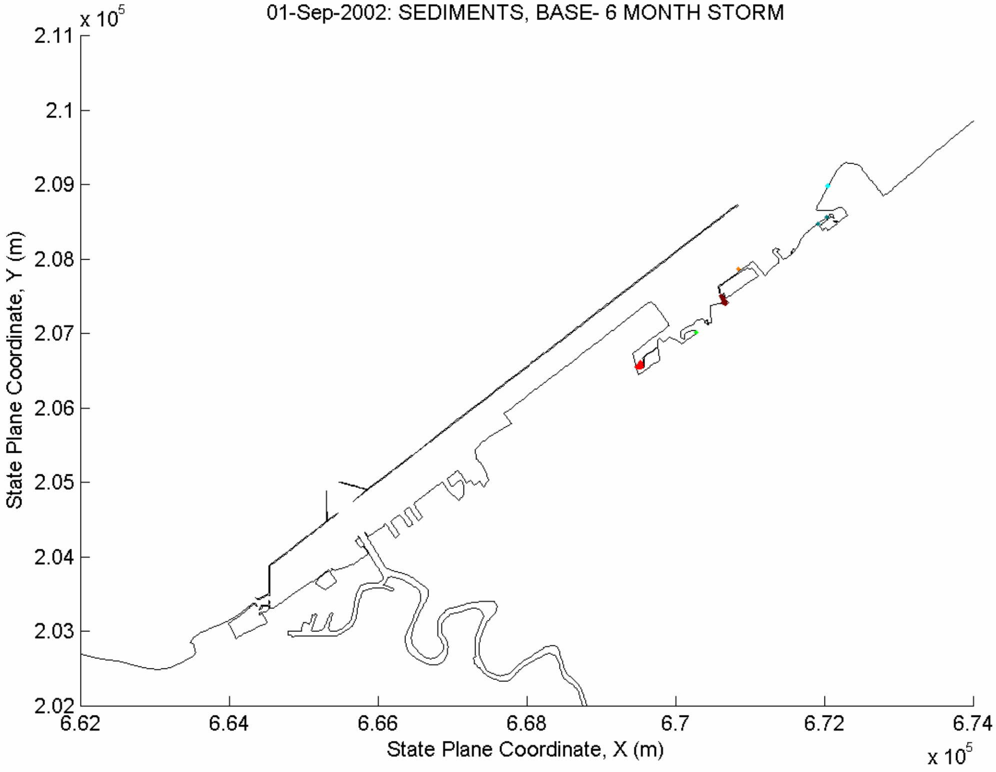
6.74
State Plane Coordinate, X (m)
x 10^5


01-Sep-2002: SEDIMENTS, BASE- 6 MONTH STORM
x 10^5
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State Plane Coordinate, Y (m)
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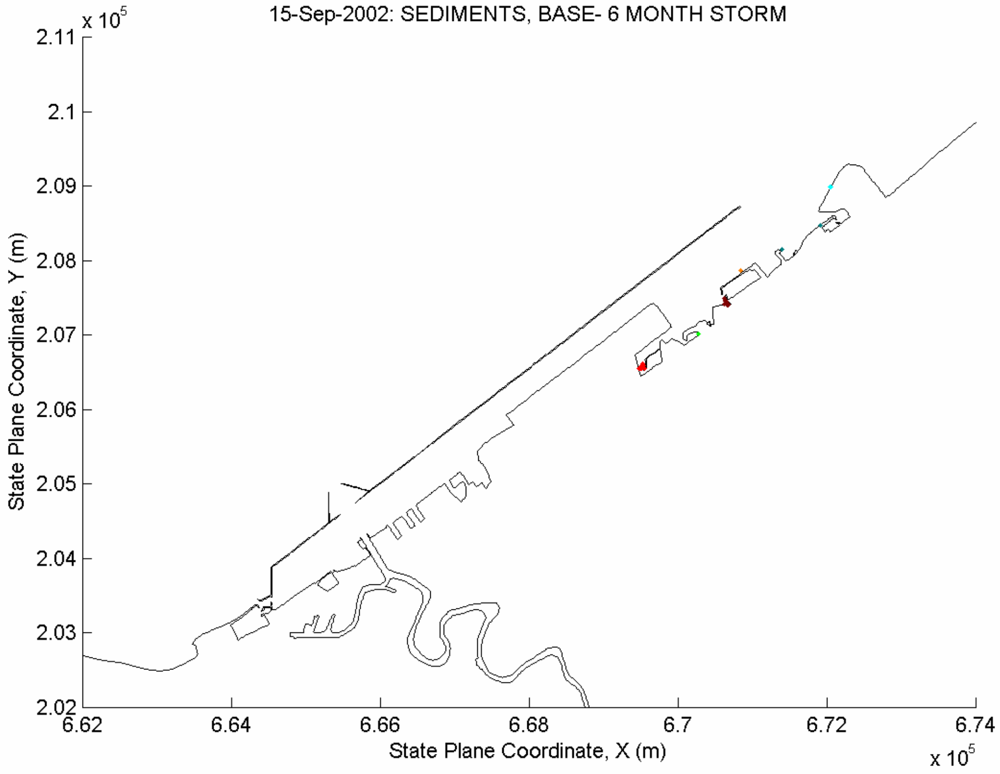
6.74
State Plane Coordinate, X (m)
x 10^5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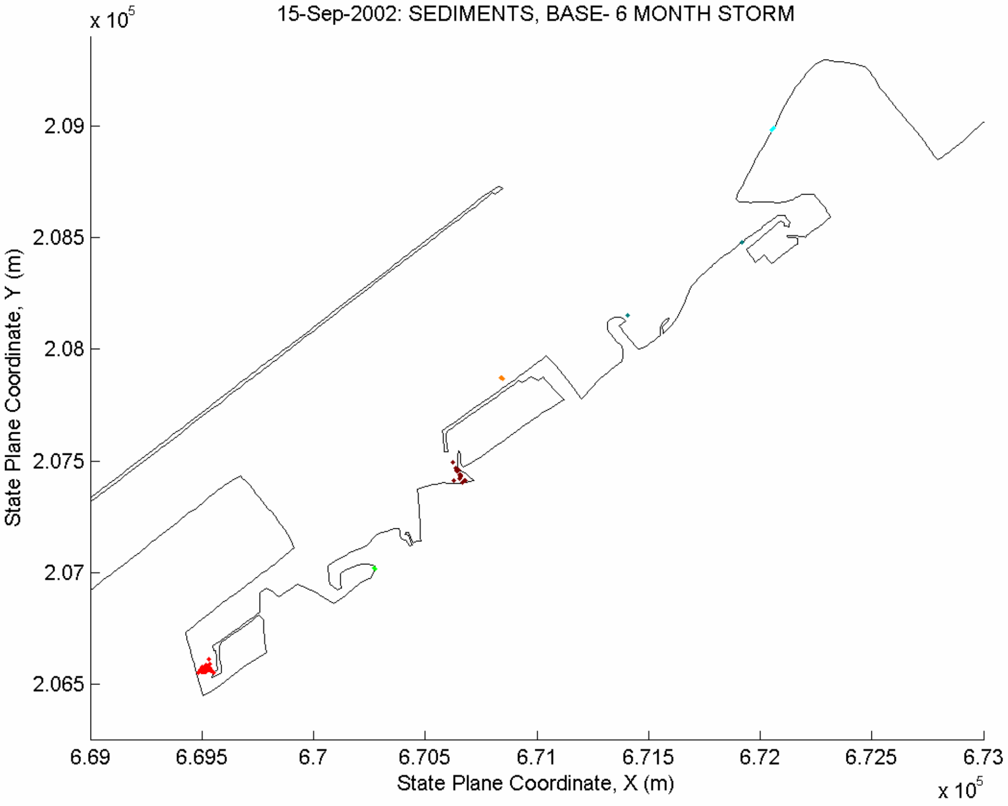
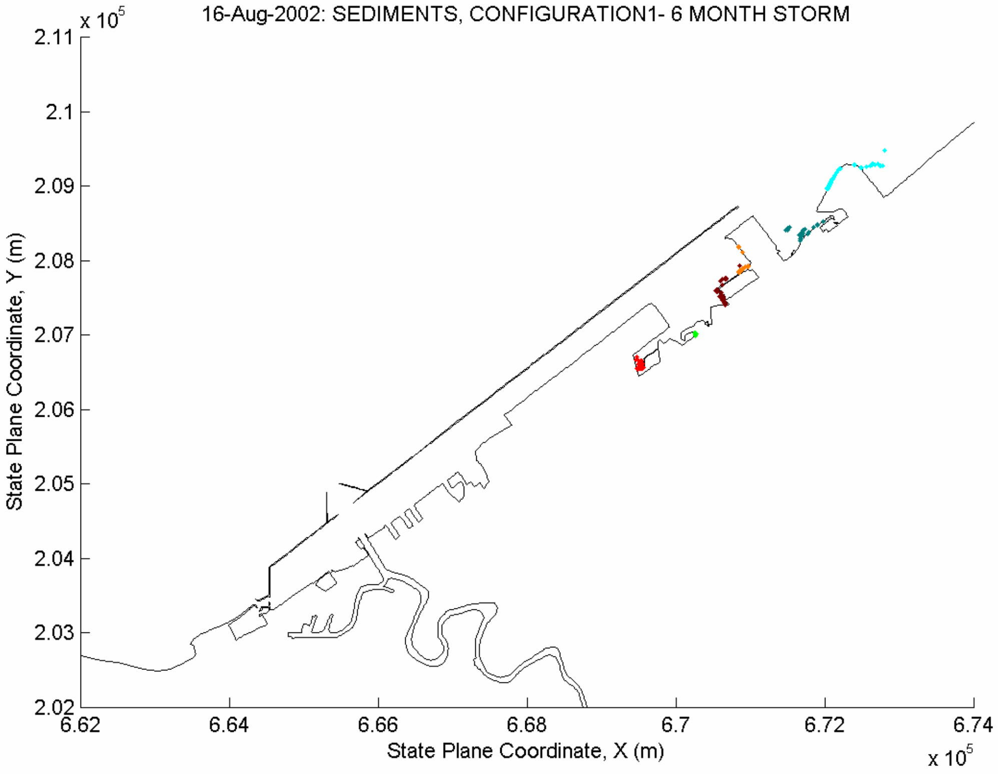
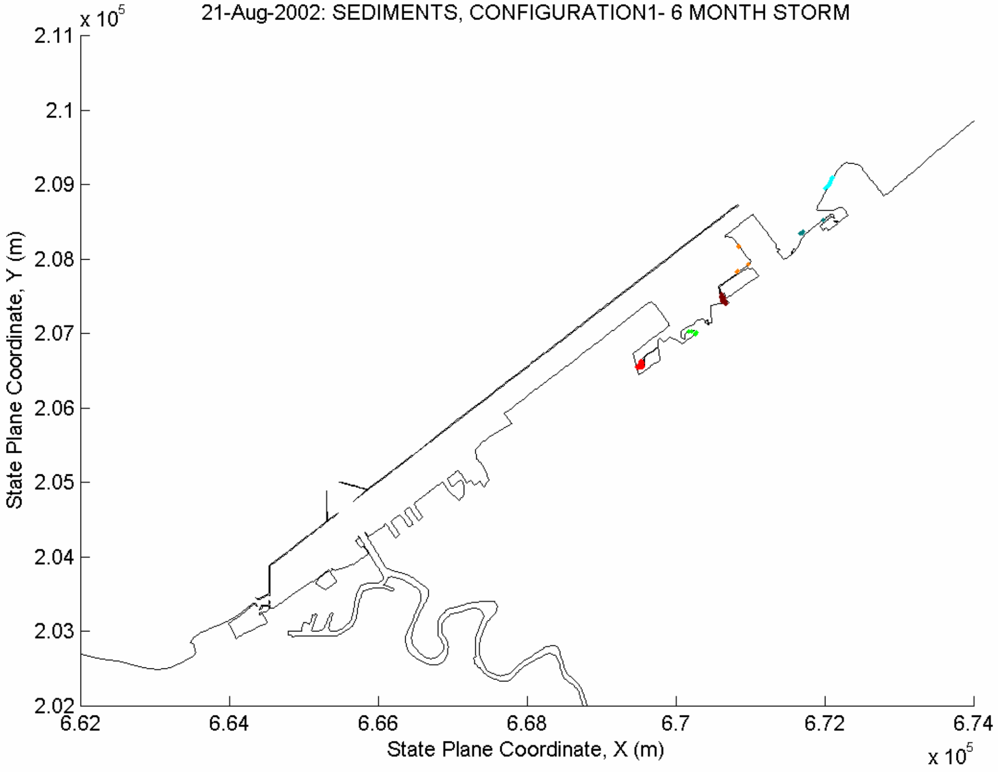
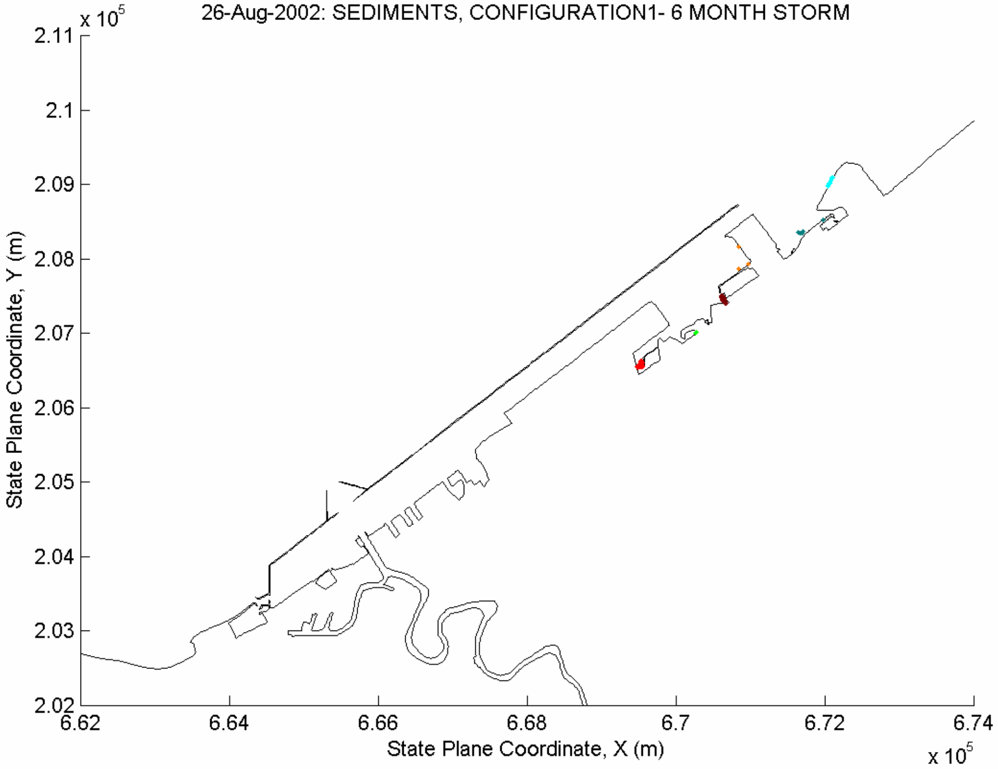

15-Sep-2002: SEDIMENTS, BASE- 6 MONTH STORM



16-Aug-2002: SEDIMENTS, CONFIGURATION1- 6 MONTH STORM



21-Aug-2002: SEDIMENTS, CONFIGURATION1- 6 MONTH STORM


26-Aug-2002: SEDIMENTS, CONFIGURATION1- 6 MONTH STORM
x 10^5
2.11
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2.02
State Plane Coordinate, Y (m)
6.62
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6.68
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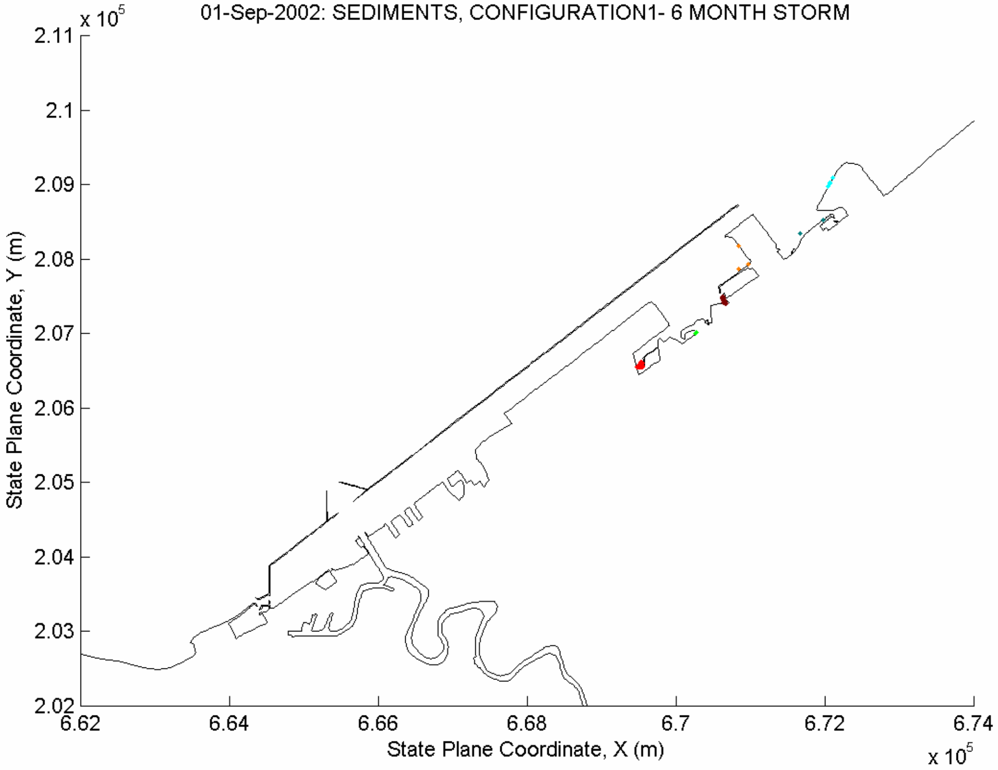
6.74
State Plane Coordinate, X (m)
x 10^5


01-Sep-2002: SEDIMENTS, CONFIGURATION1- 6 MONTH STORM
x 10^5
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2.04
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2.02
State Plane Coordinate, Y (m)
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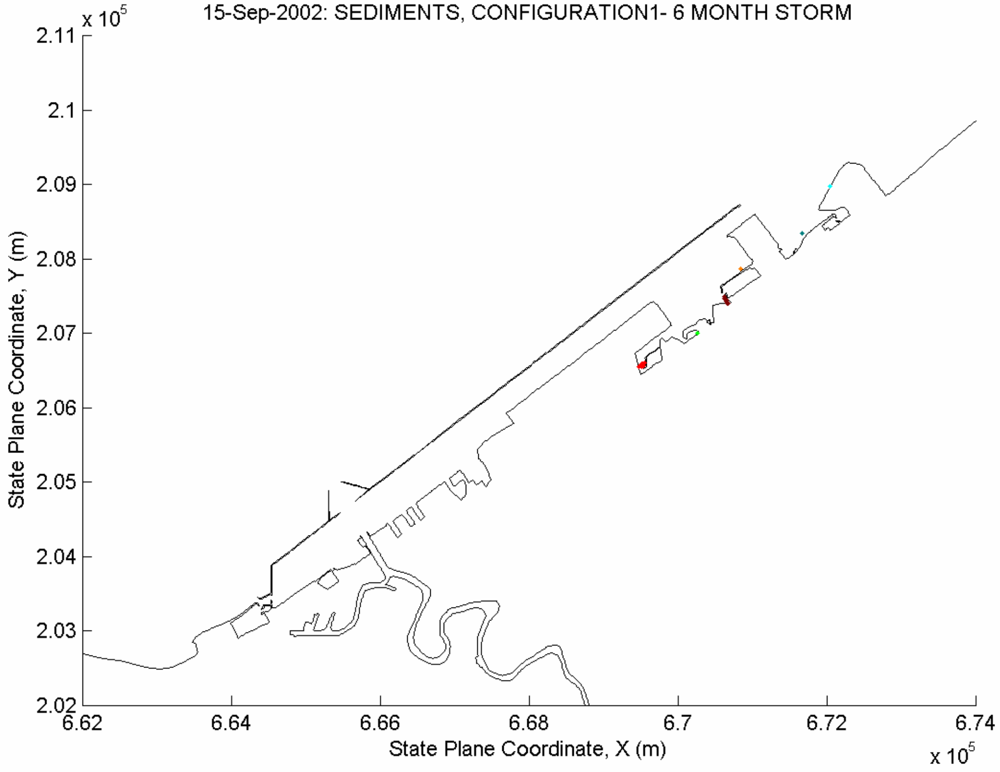
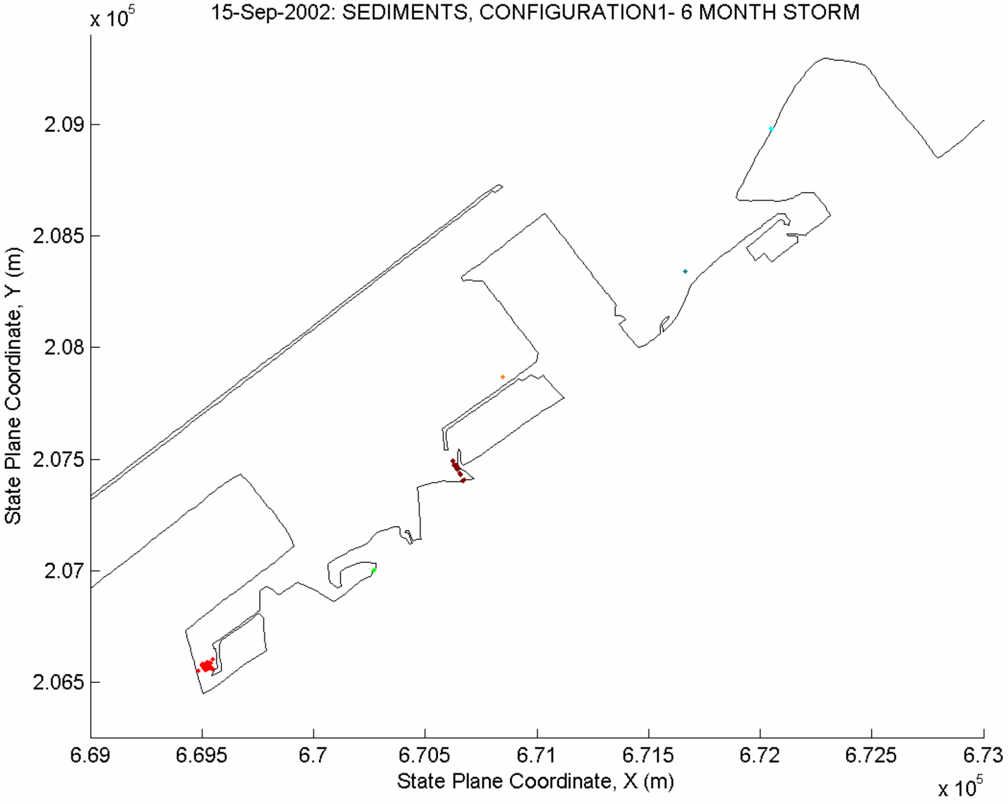
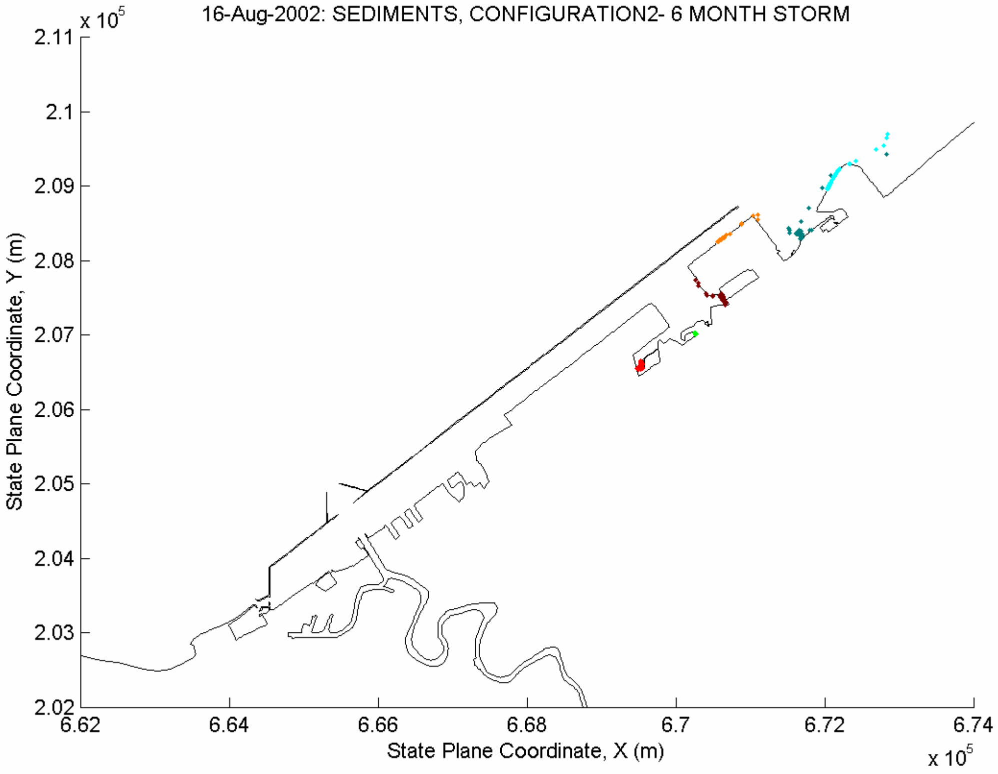
6.74
State Plane Coordinate, X (m)
x 10^5


15-Sep-2002: SEDIMENTS, CONFIGURATION1- 6 MONTH STORM


15-Sep-2002: SEDIMENTS, CONFIGURATION1- 6 MONTH STORM


16-Aug-2002: SEDIMENTS, CONFIGURATION2- 6 MONTH STORM
x 10^5
2.11
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State Plane Coordinate, Y (m)
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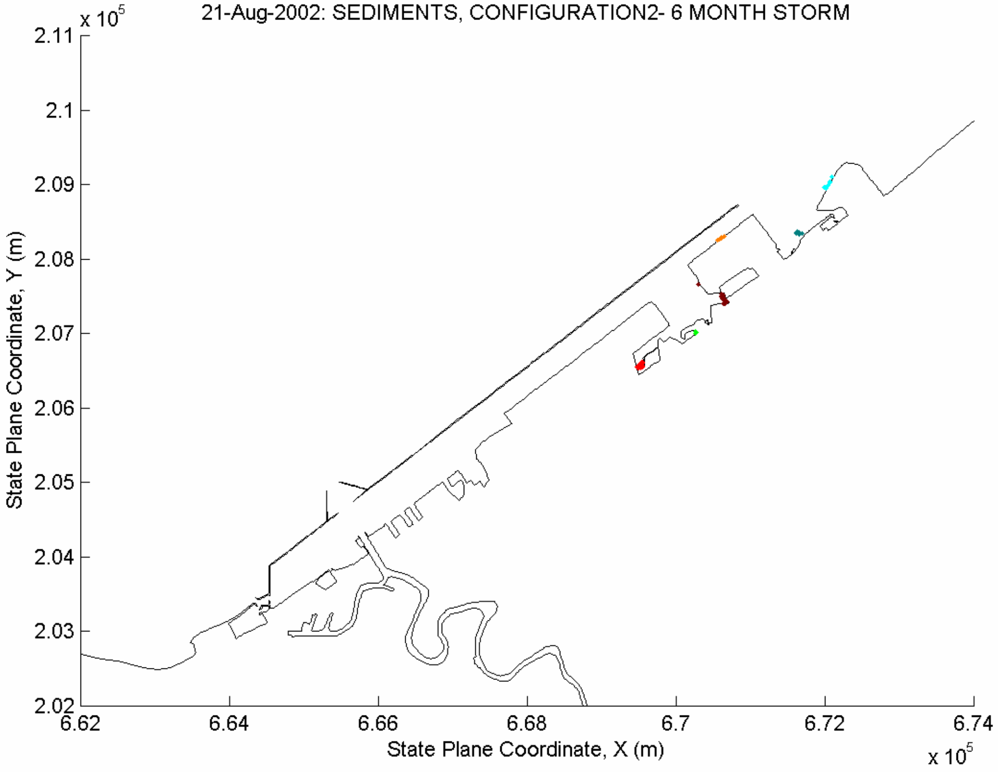
6.74
State Plane Coordinate, X (m)
x 10^5


21-Aug-2002: SEDIMENTS, CONFIGURATION2- 6 MONTH STORM
x 10^5
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State Plane Coordinate, Y (m)
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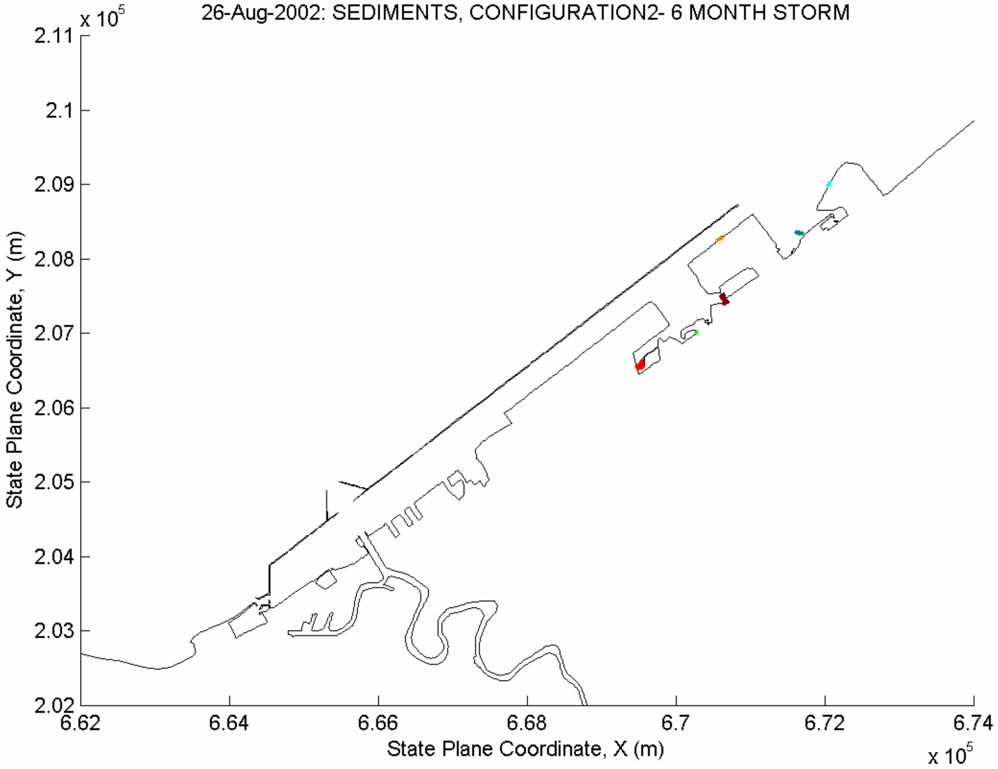
State Plane Coordinate, X (m)
x 10^5


26-Aug-2002: SEDIMENTS, CONFIGURATION2- 6 MONTH STORM
x 10^5
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State Plane Coordinate, Y (m)
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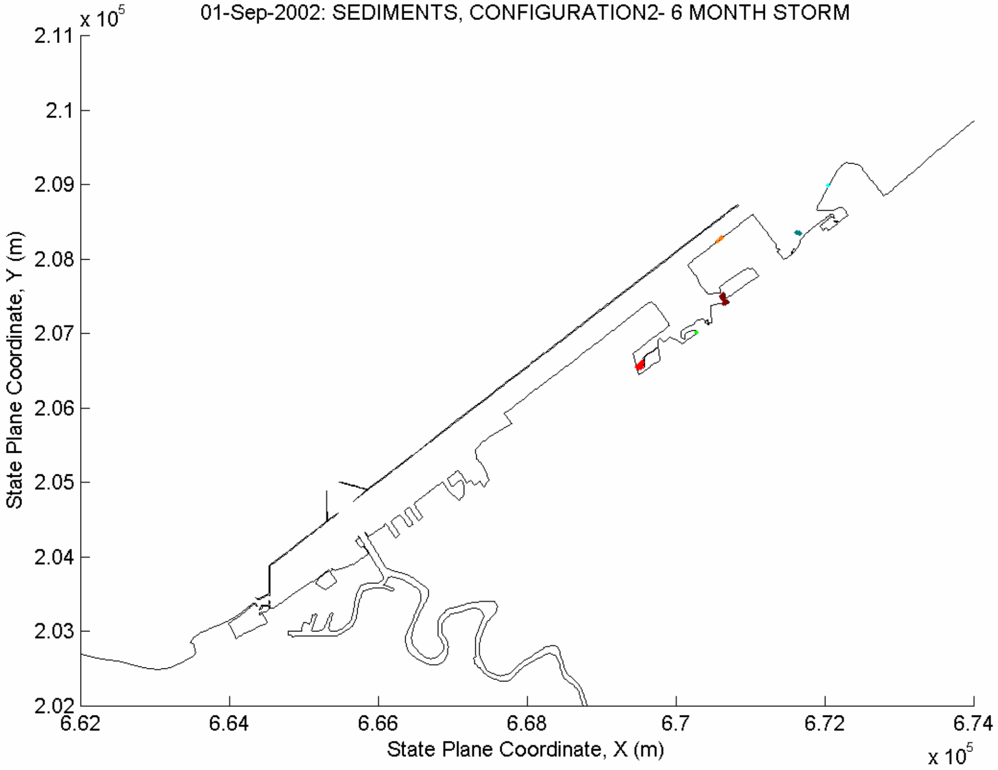
State Plane Coordinate, X (m)
x 10^5


01-Sep-2002: SEDIMENTS, CONFIGURATION2- 6 MONTH STORM
x 10^5
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State Plane Coordinate, Y (m)
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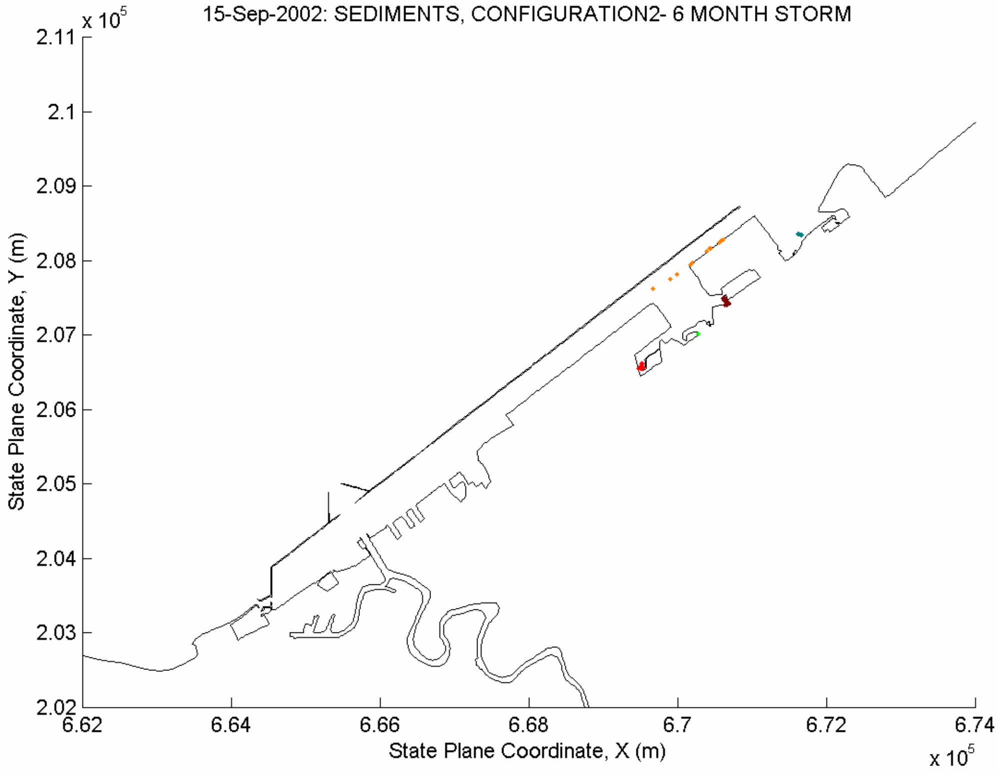
State Plane Coordinate, X (m)
x 10^5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x 10^5
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State Plane Coordinate, Y (m)
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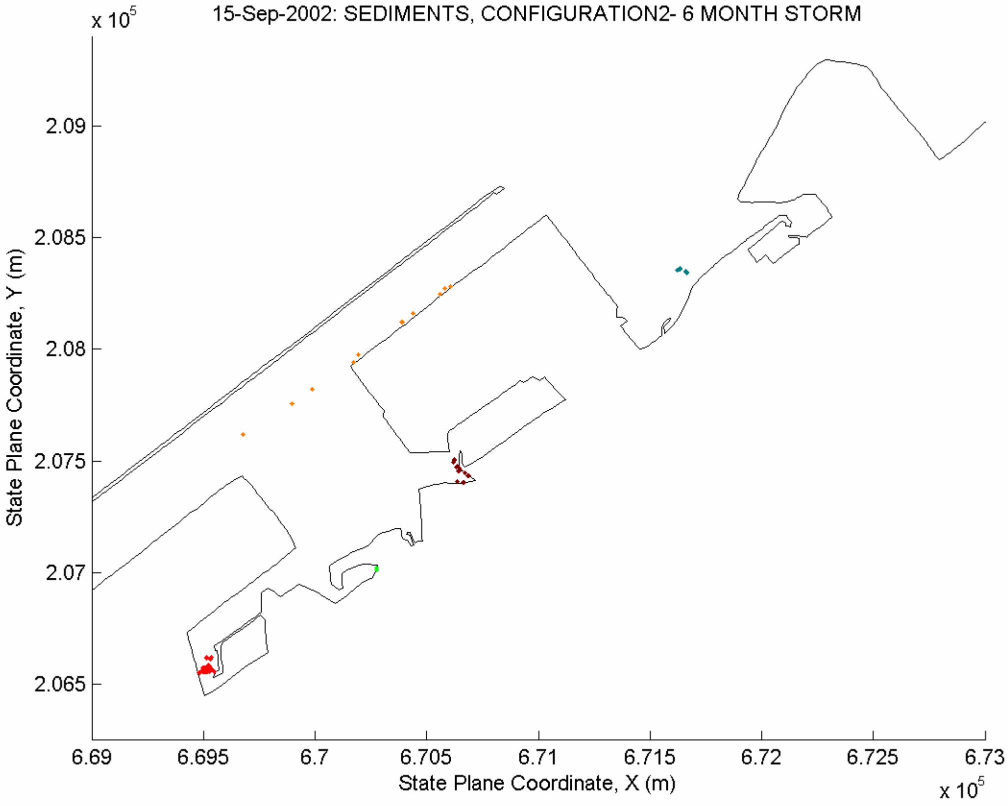
State Plane Coordinate, X (m)
x 10^5


15-Sep-2002: SEDIMENTS, CONFIGURATION2- 6 MONTH STORM
x 10^5
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State Plane Coordinate, Y (m)
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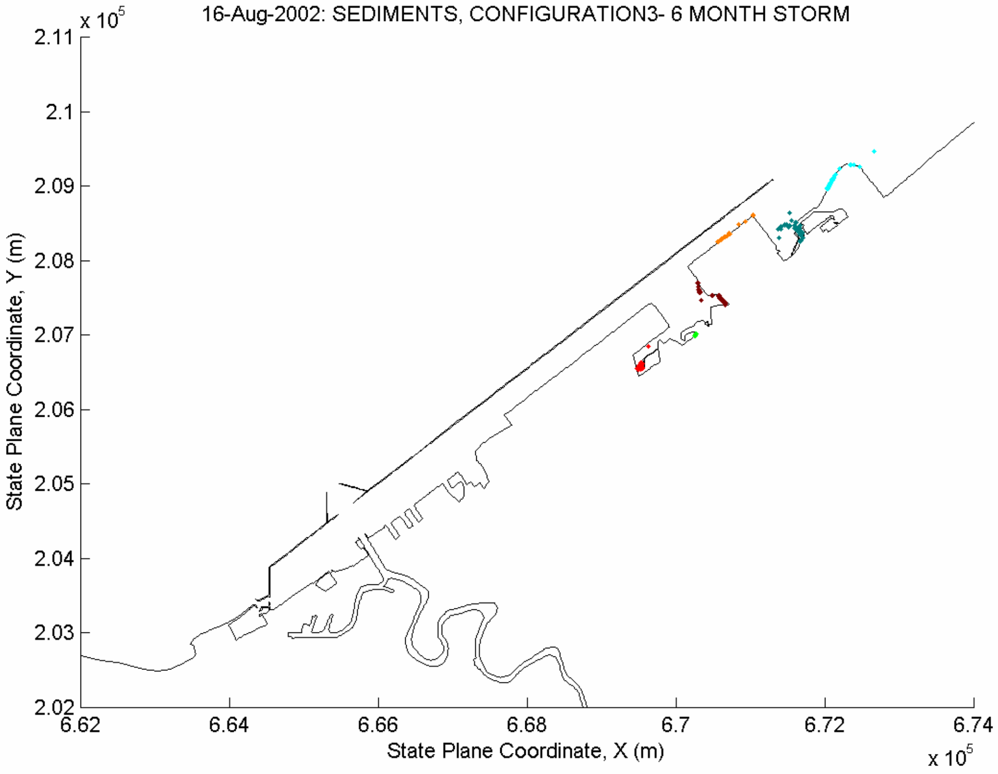
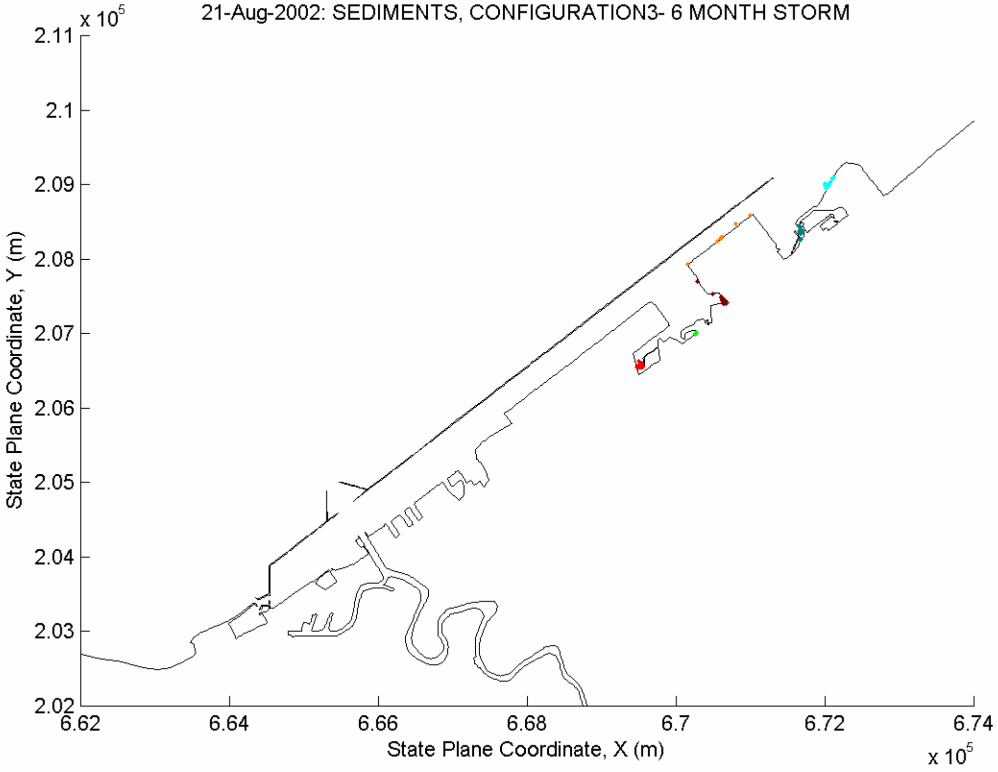
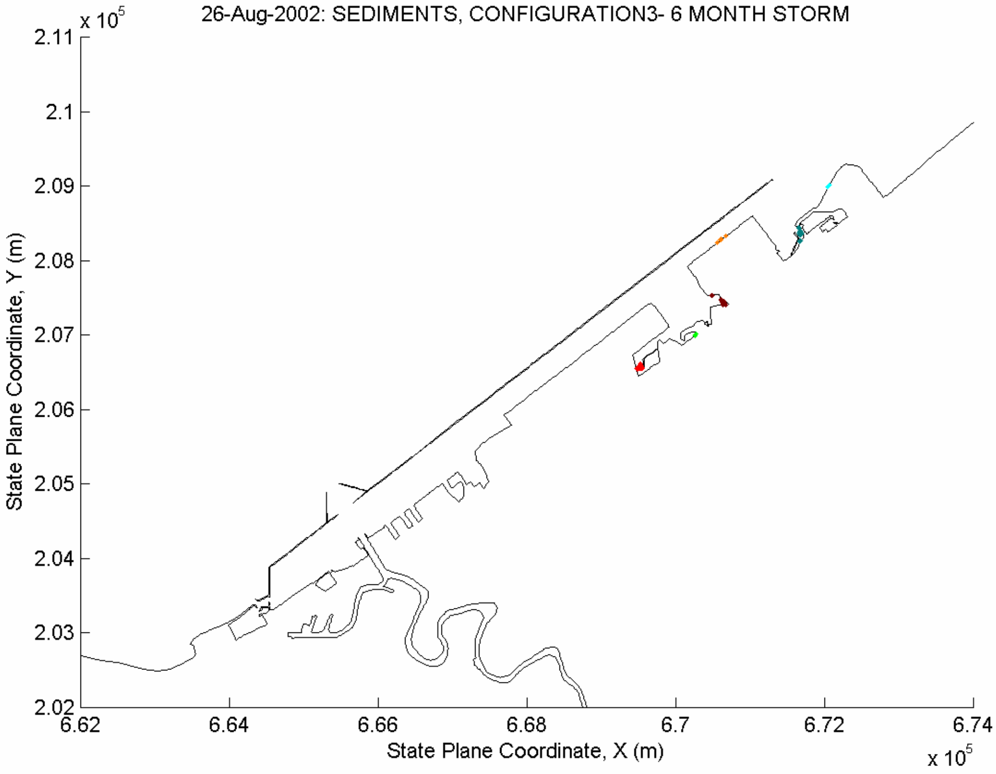
State Plane Coordinate, X (m)
x 10^5


16-Aug-2002: SEDIMENTS, CONFIGURATION3- 6 MONTH STORM


21-Aug-2002: SEDIMENTS, CONFIGURATION3- 6 MONTH STORM


26-Aug-2002: SEDIMENTS, CONFIGURATION3- 6 MONTH STORM
x 10^5
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State Plane Coordinate, Y (m)
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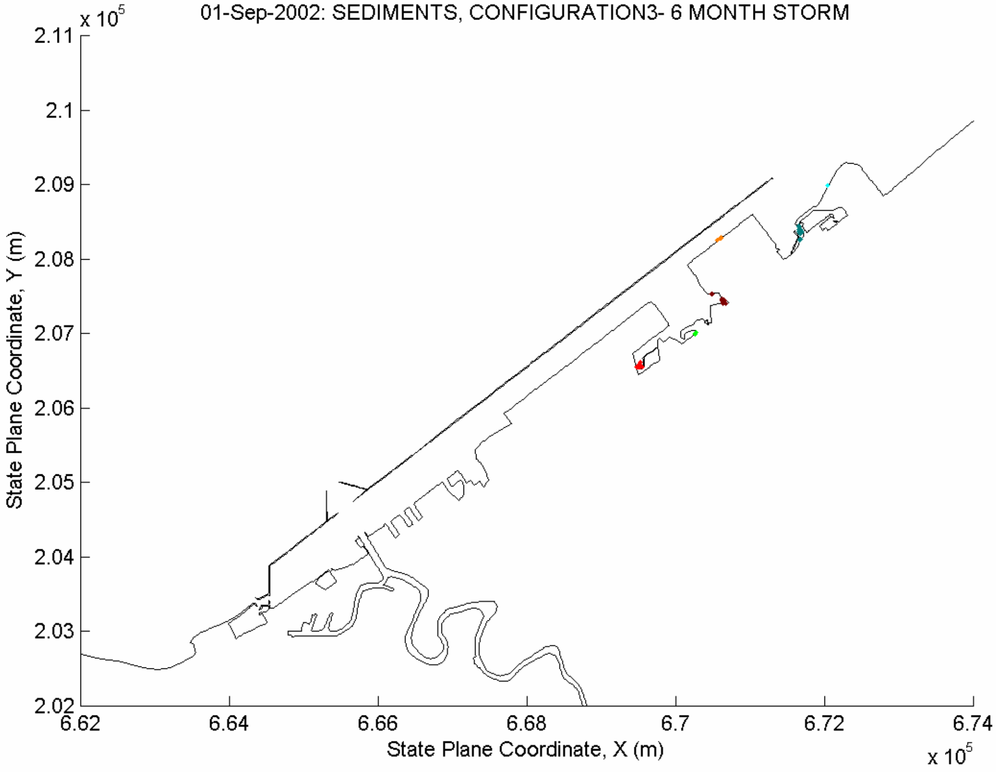
State Plane Coordinate, X (m)
x 10^5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x 10^5
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State Plane Coordinate, Y (m)
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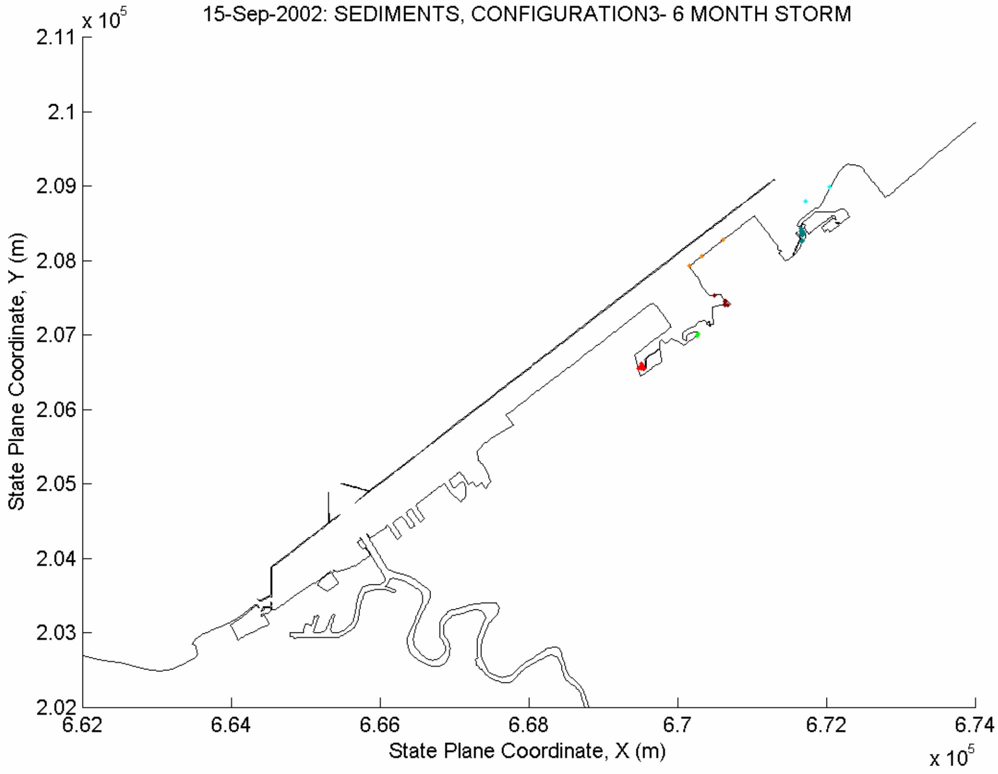
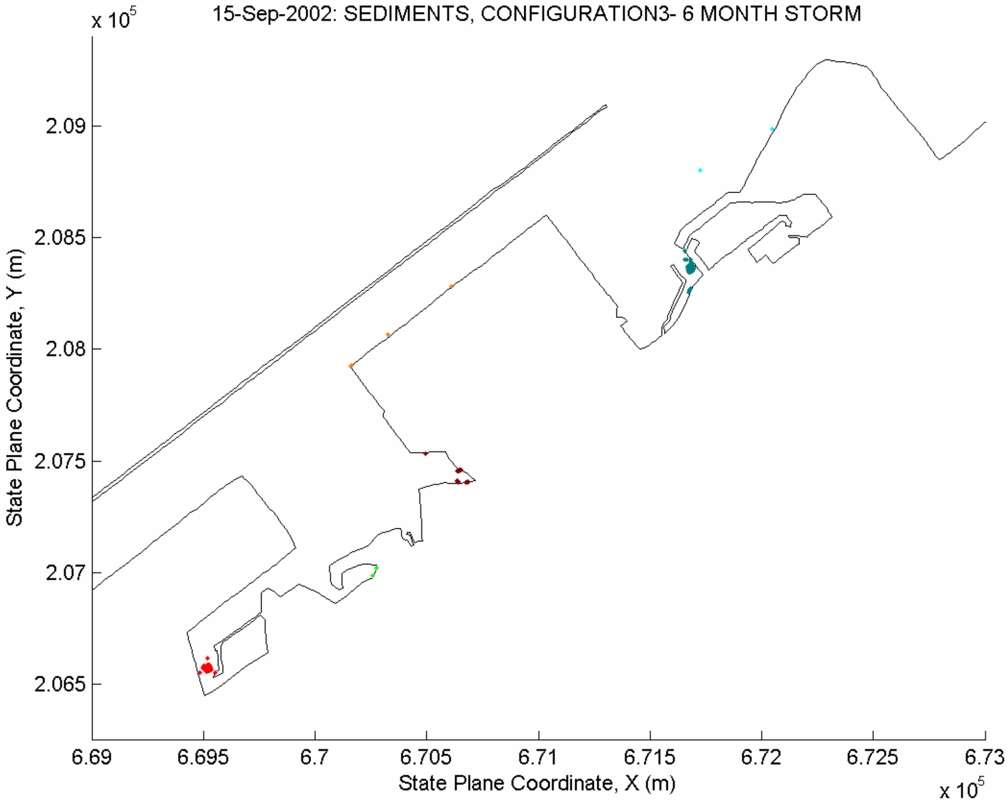
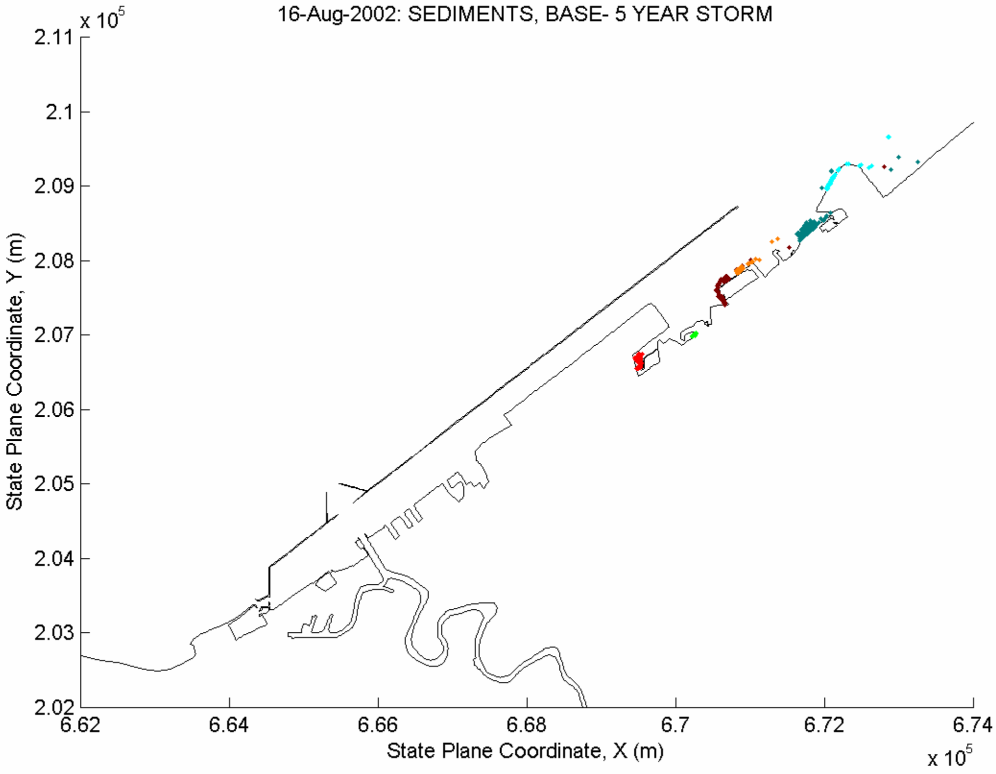
State Plane Coordinate, X (m)
x 10^5



15-Sep-2002: SEDIMENTS, CONFIGURATION3- 6 MONTH STORM



15-Sep-2002: SEDIMENTS, CONFIGURATION3- 6 MONTH STORM


16-Aug-2002: SEDIMENTS, BASE- 5 YEAR STORM
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State Plane Coordinate, Y (m)
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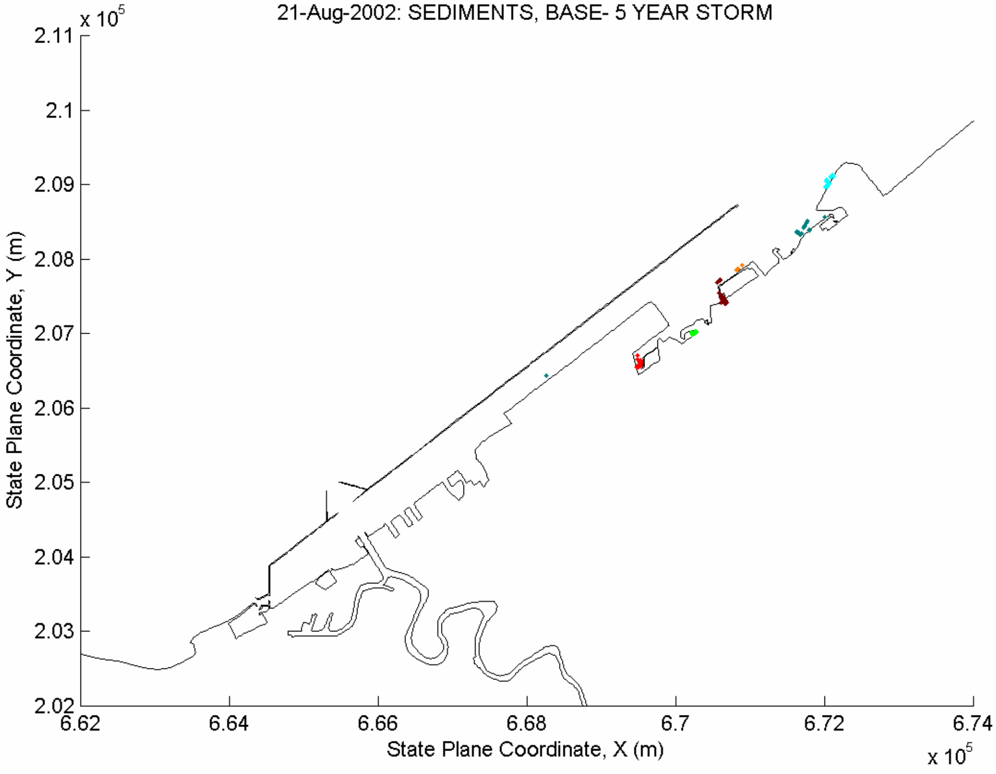
State Plane Coordinate, X (m)
x 10^5


21-Aug-2002: SEDIMENTS, BASE- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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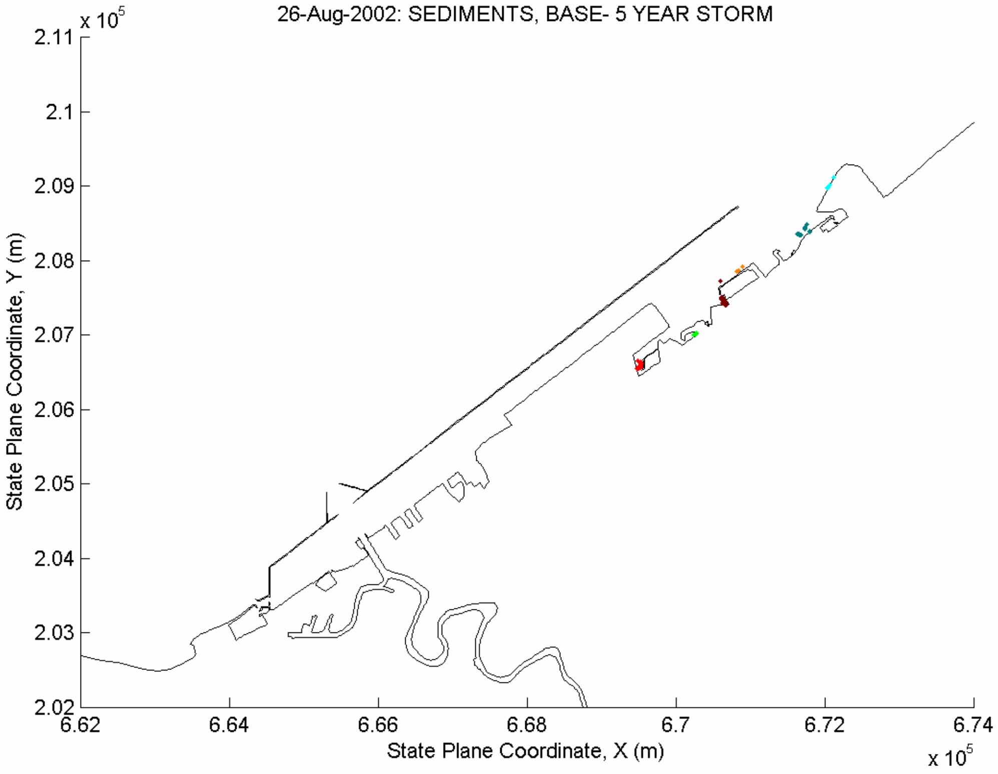
State Plane Coordinate, X (m)
x 10^5


26-Aug-2002: SEDIMENTS, BASE- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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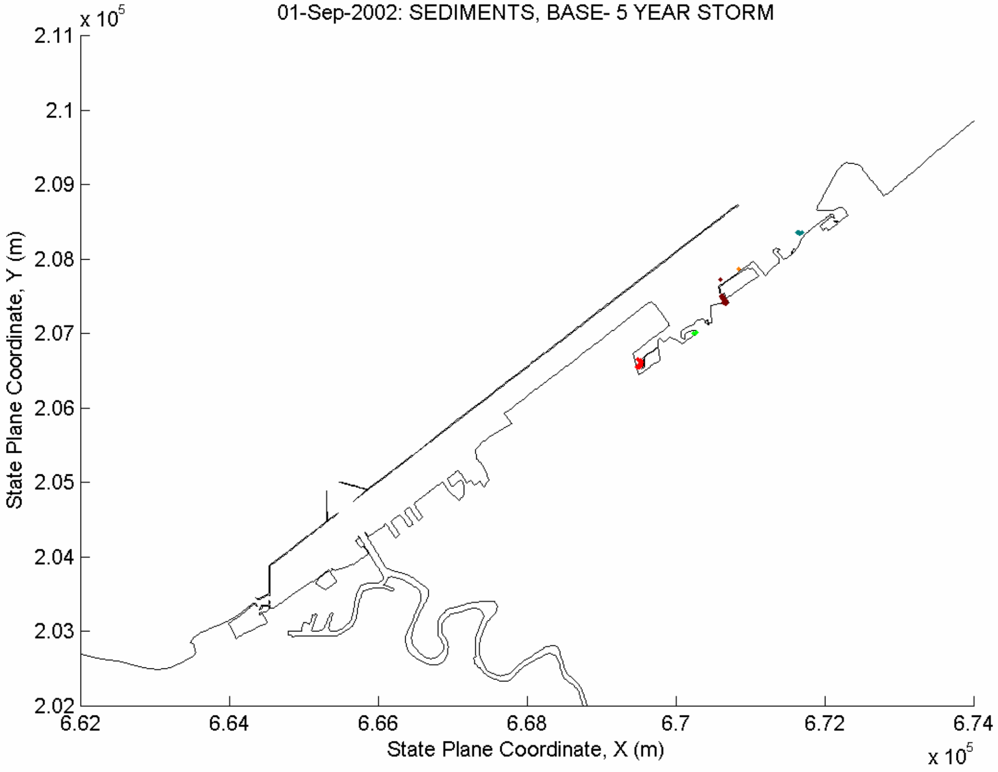
State Plane Coordinate, X (m)
x 10^5


01-Sep-2002: SEDIMENTS, BASE- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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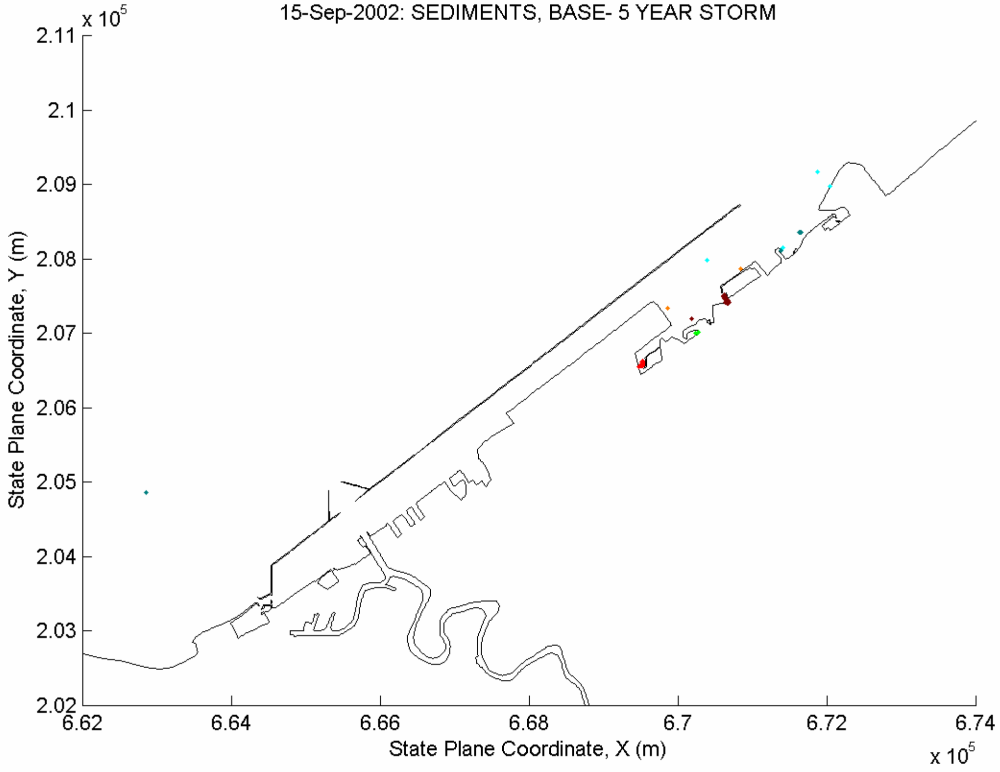
State Plane Coordinate, X (m)
x 10^5


15-Sep-2002: SEDIMENTS, BASE- 5 YEAR STORM
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State Plane Coordinate, Y (m)
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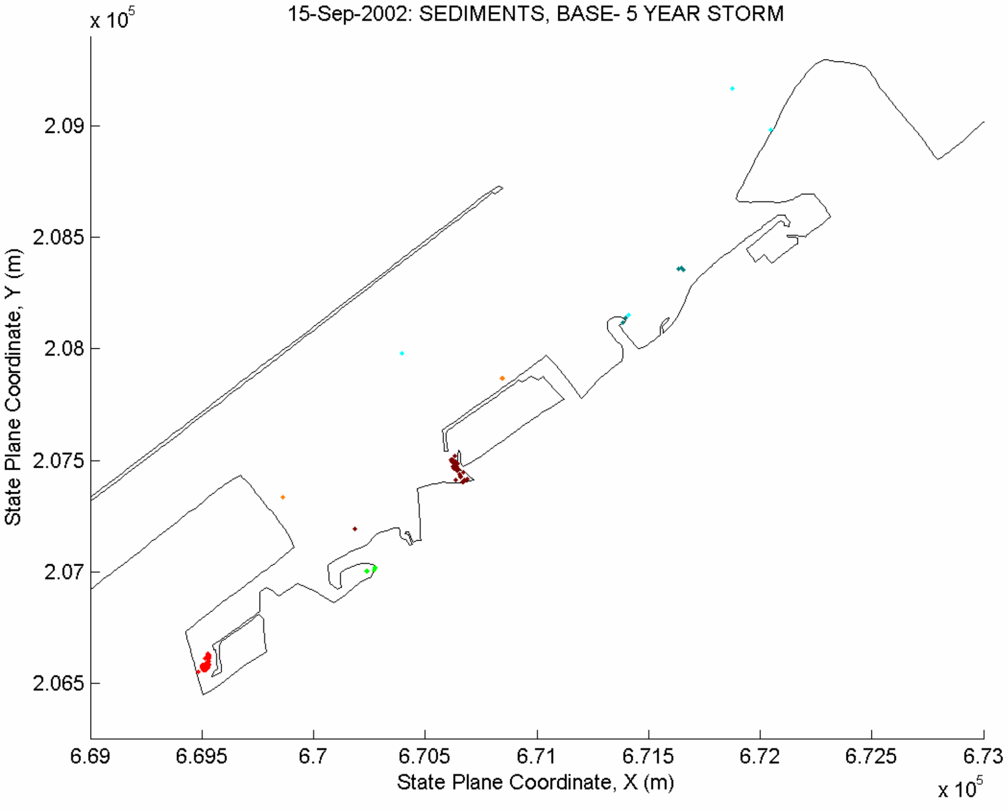
State Plane Coordinate, X (m)
x 10^5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State Plane Coordinate, Y (m)
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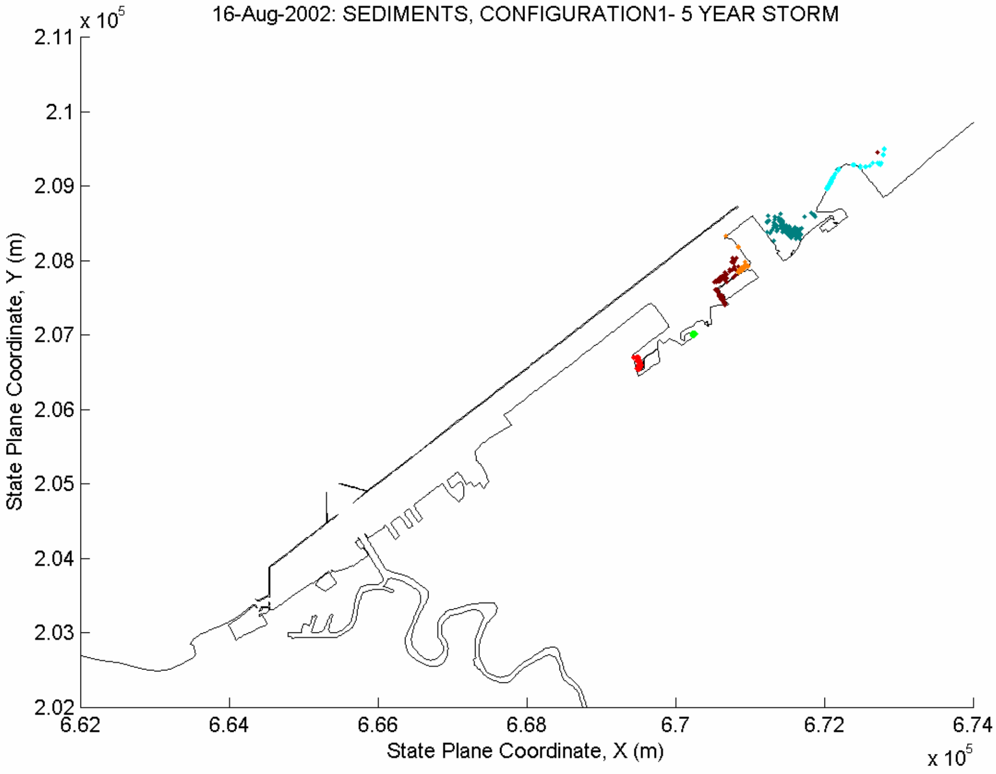
State Plane Coordinate, X (m)
x 10^5


16-Aug-2002: SEDIMENTS, CONFIGURATION1- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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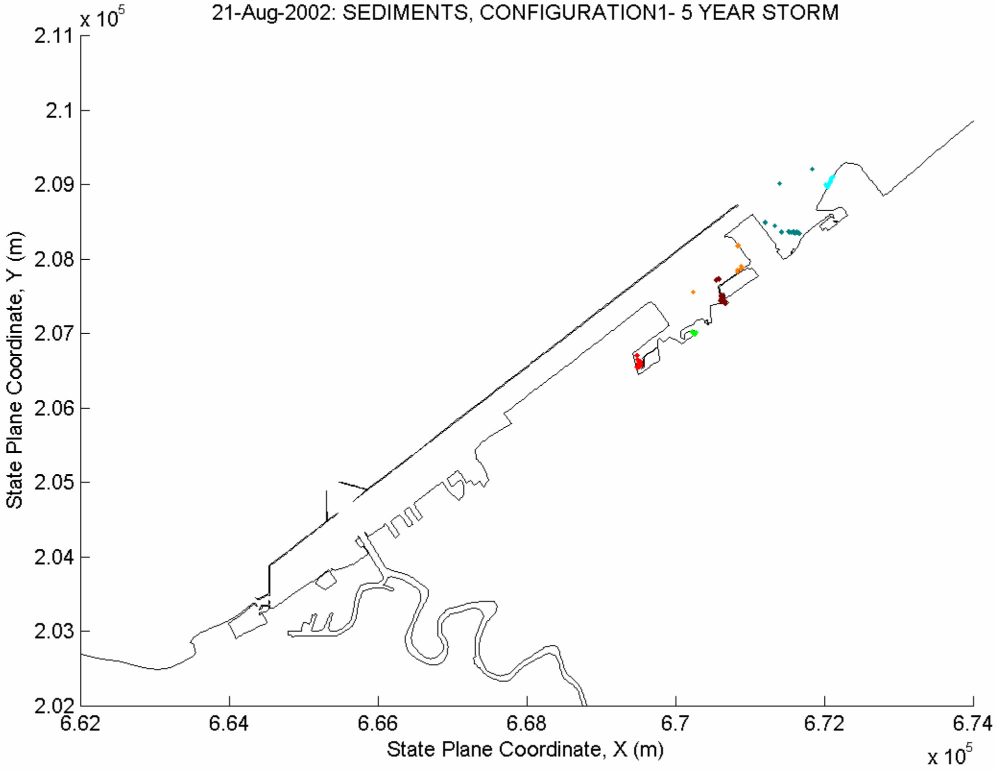
State Plane Coordinate, X (m)
x 10^5


21-Aug-2002: SEDIMENTS, CONFIGURATION1- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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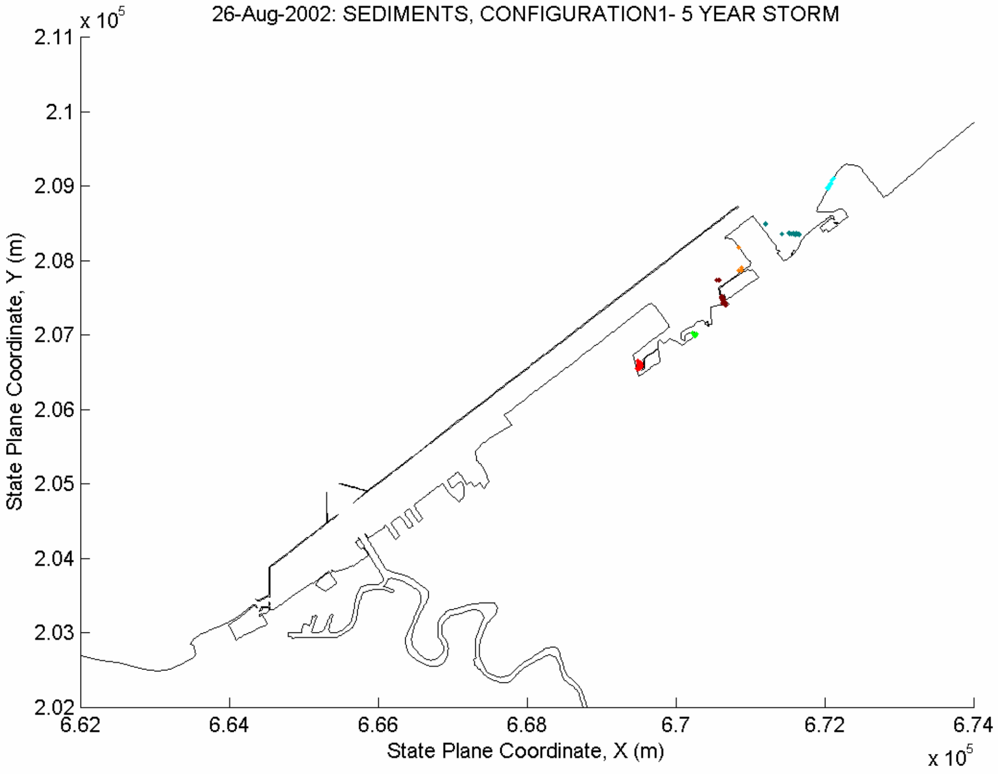
State Plane Coordinate, X (m)
x 10^5


26-Aug-2002: SEDIMENTS, CONFIGURATION1- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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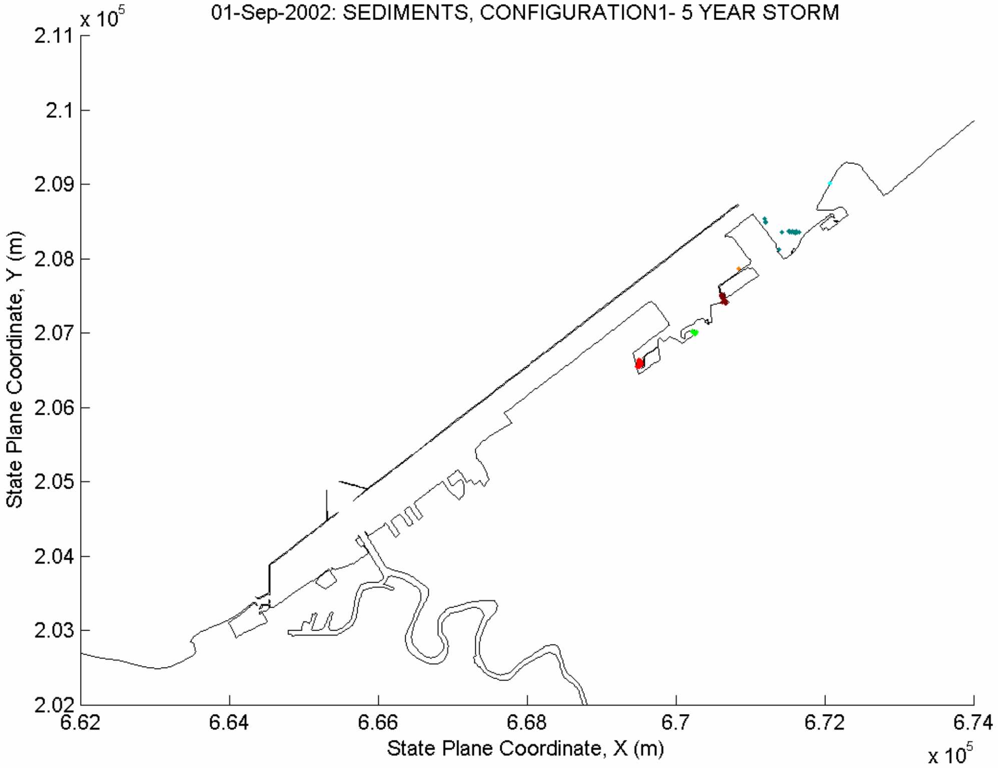
State Plane Coordinate, X (m)
x 10^5


01-Sep-2002: SEDIMENTS, CONFIGURATION1- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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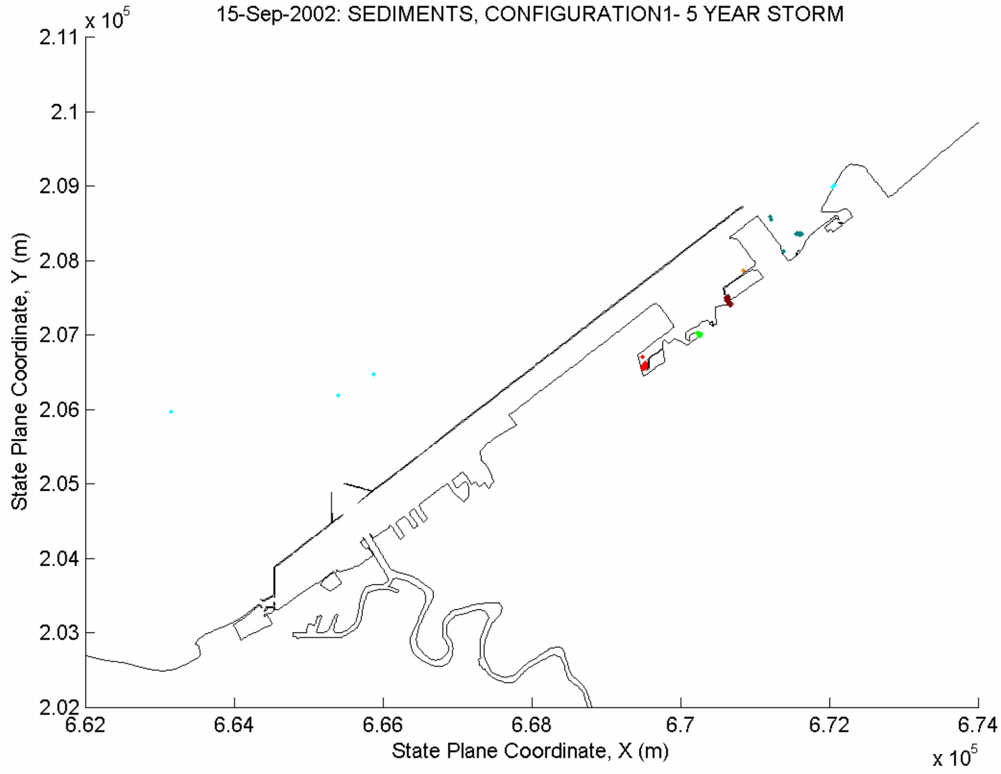
State Plane Coordinate, X (m)
x 10^5


15-Sep-2002: SEDIMENTS, CONFIGURATION1- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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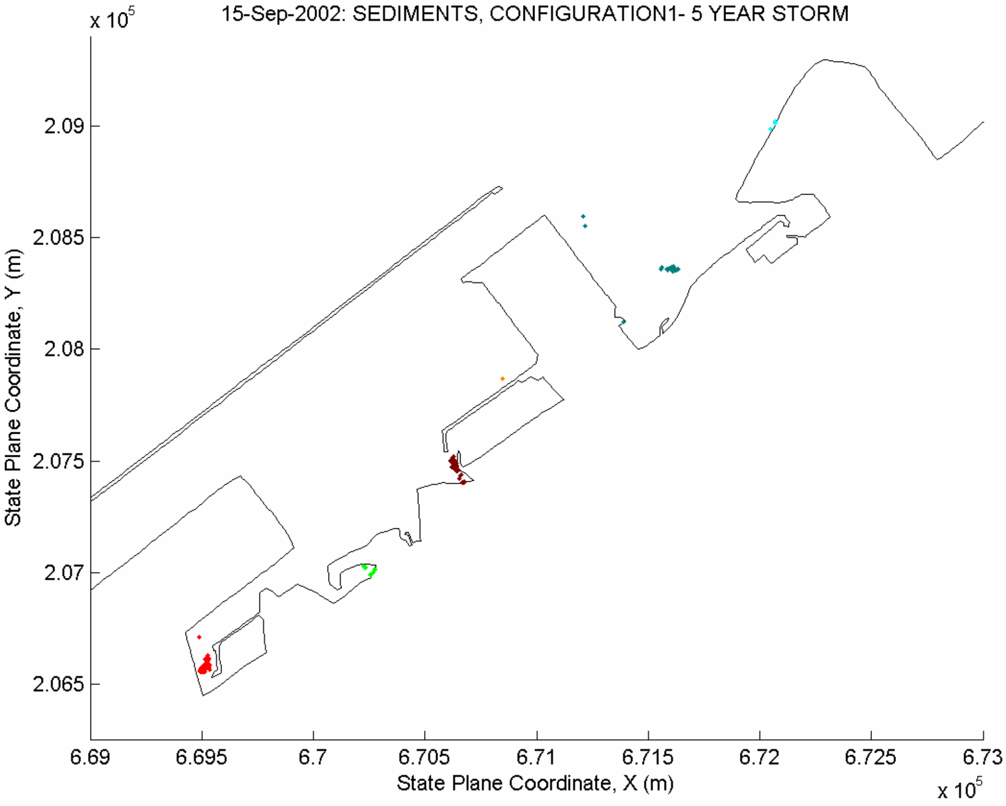
State Plane Coordinate, X (m)
x 10^5


15-Sep-2002: SEDIMENTS, CONFIGURATION1- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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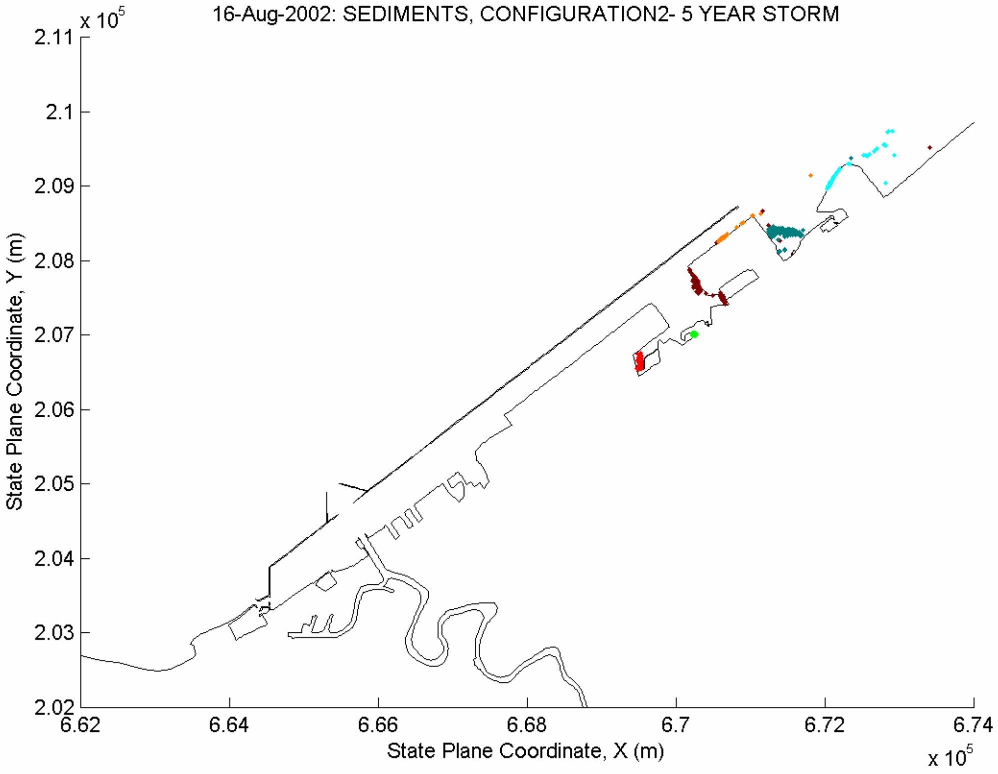
State Plane Coordinate, X (m)
x 10^5


16-Aug-2002: SEDIMENTS, CONFIGURATION2- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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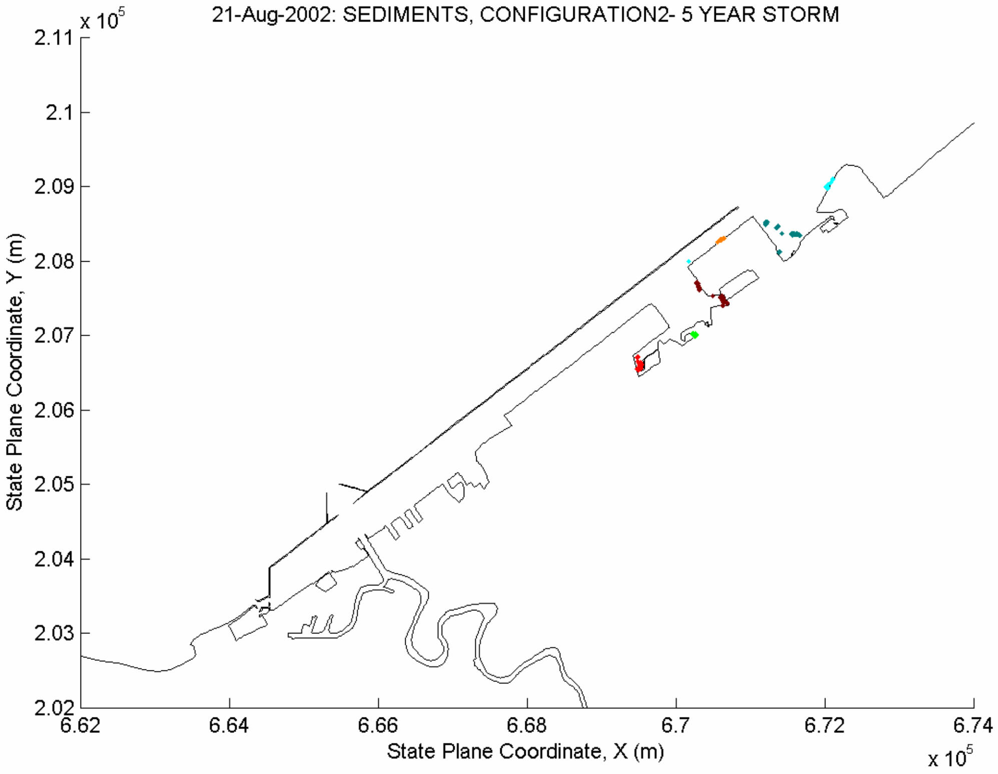
State Plane Coordinate, X (m)
x 10^5


21-Aug-2002: SEDIMENTS, CONFIGURATION2- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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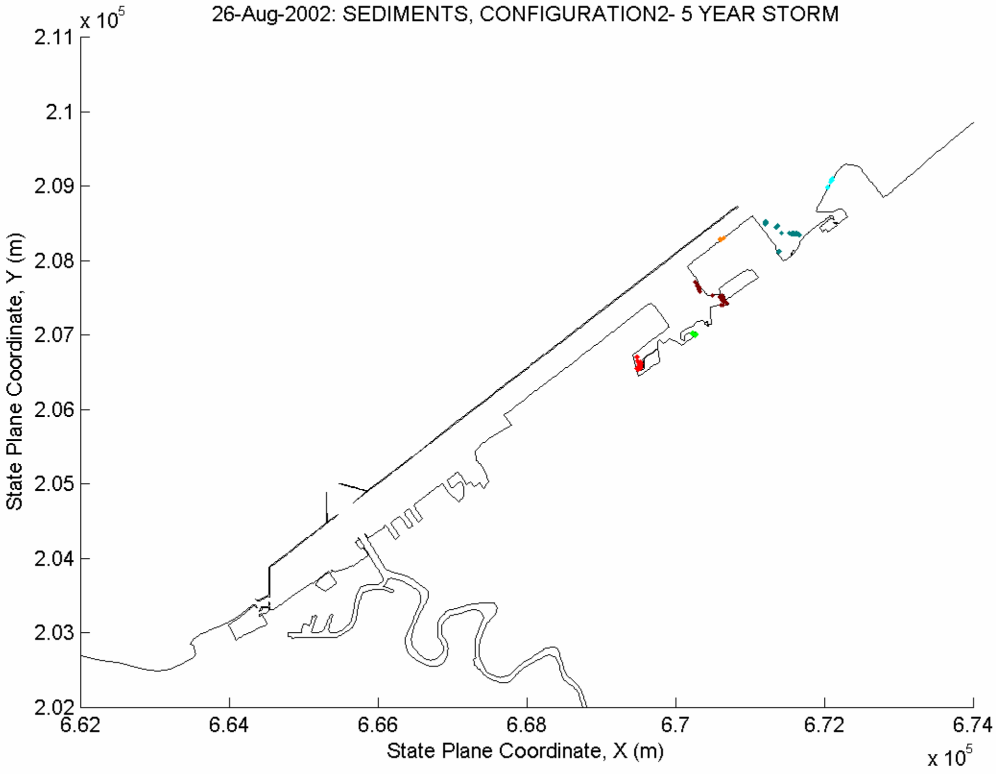
State Plane Coordinate, X (m)
x 10^5


26-Aug-2002: SEDIMENTS, CONFIGURATION2- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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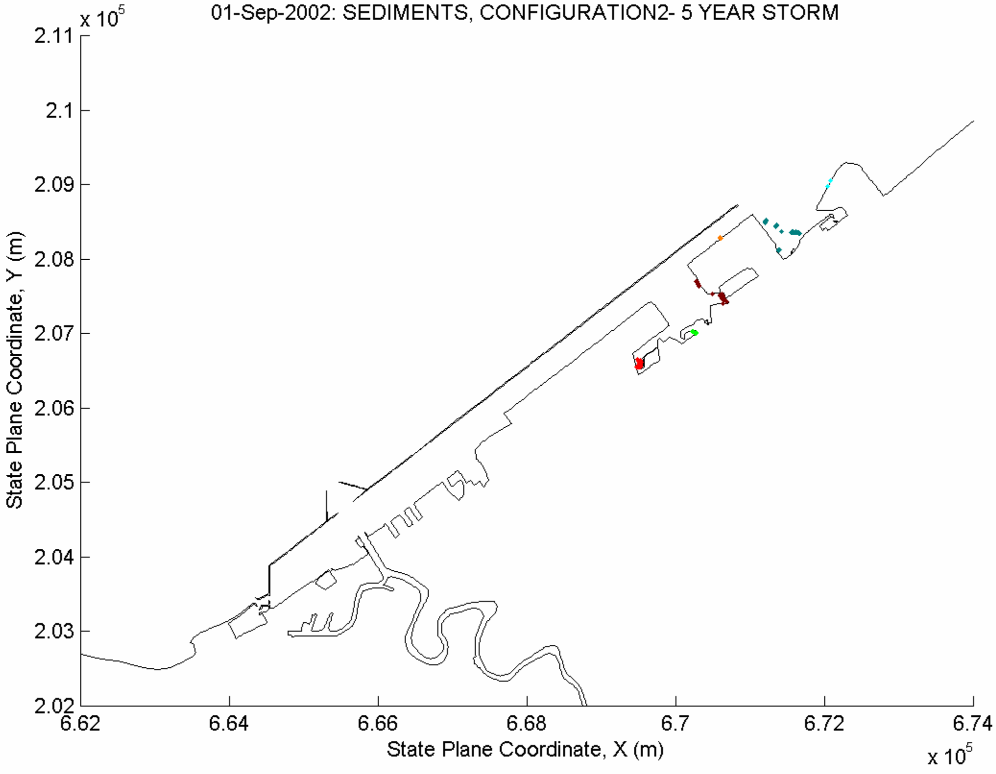
State Plane Coordinate, X (m)
x 10^5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x 10^5
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State Plane Coordinate, Y (m)
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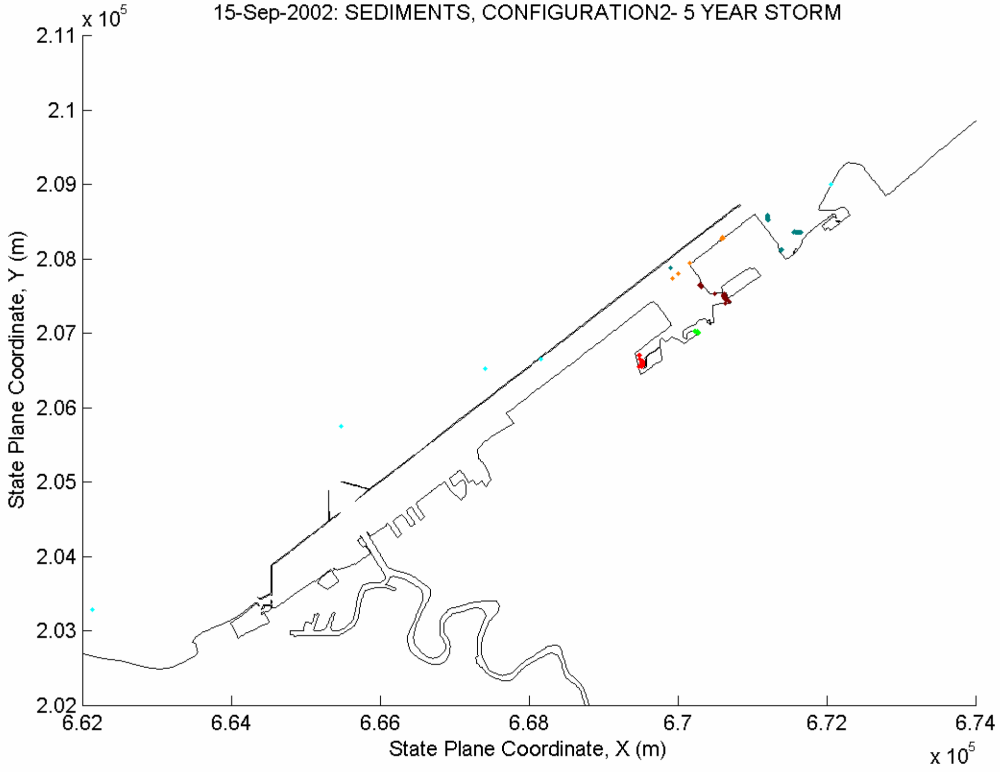
State Plane Coordinate, X (m)
x 10^5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x 10^5
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State Plane Coordinate, Y (m)
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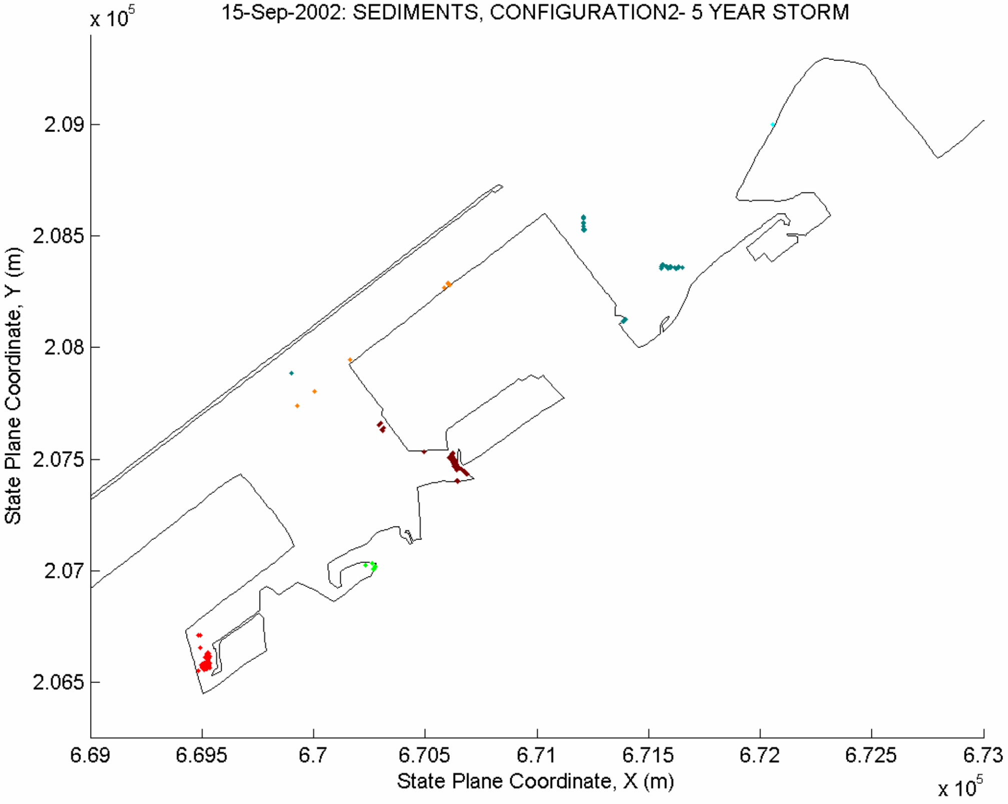
State Plane Coordinate, X (m)
x 10^5


15-Sep-2002: SEDIMENTS, CONFIGURATION2- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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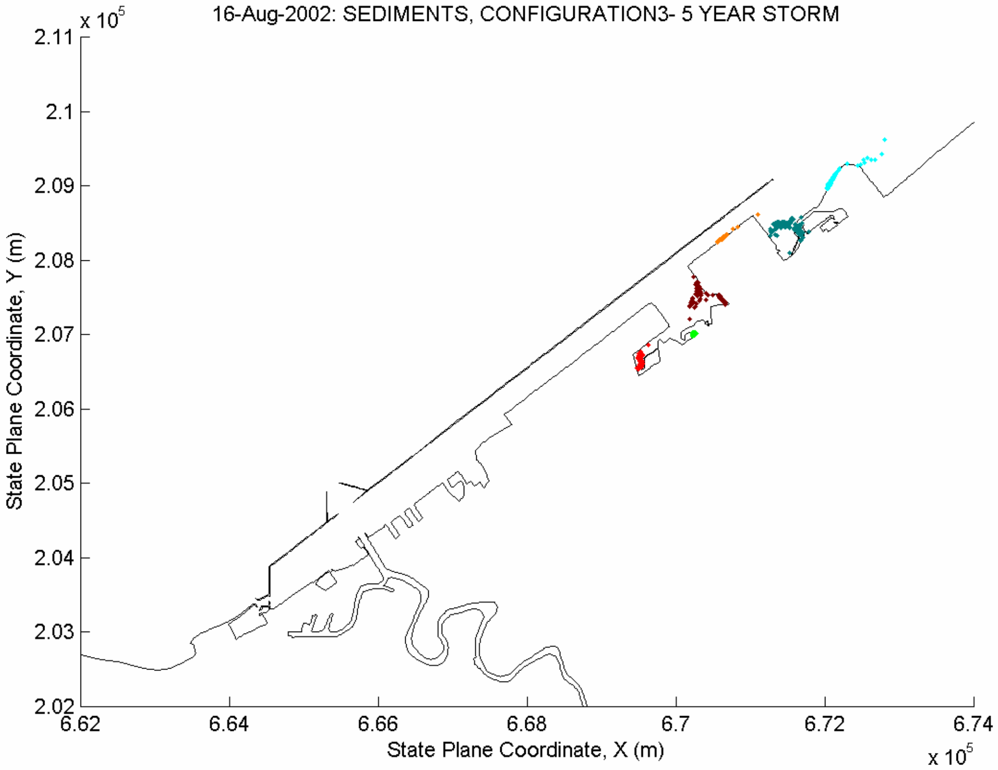
State Plane Coordinate, X (m)
x 10^5



16-Aug-2002: SEDIMENTS, CONFIGURATION3- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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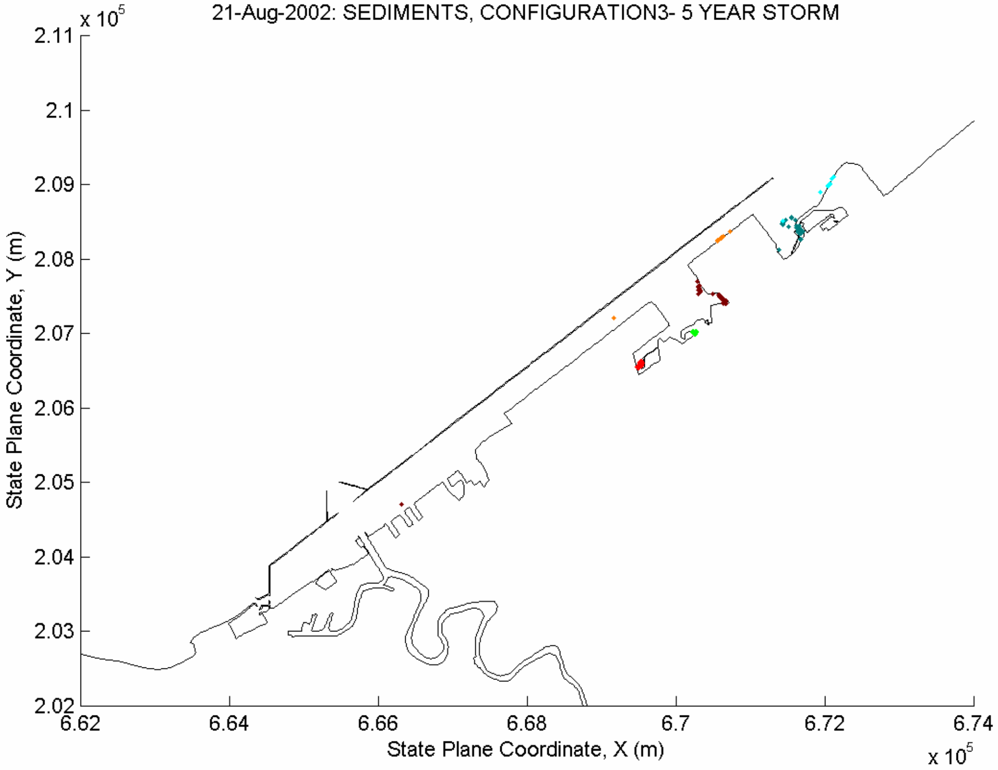
State Plane Coordinate, X (m)
x 10^5



21-Aug-2002: SEDIMENTS, CONFIGURATION3- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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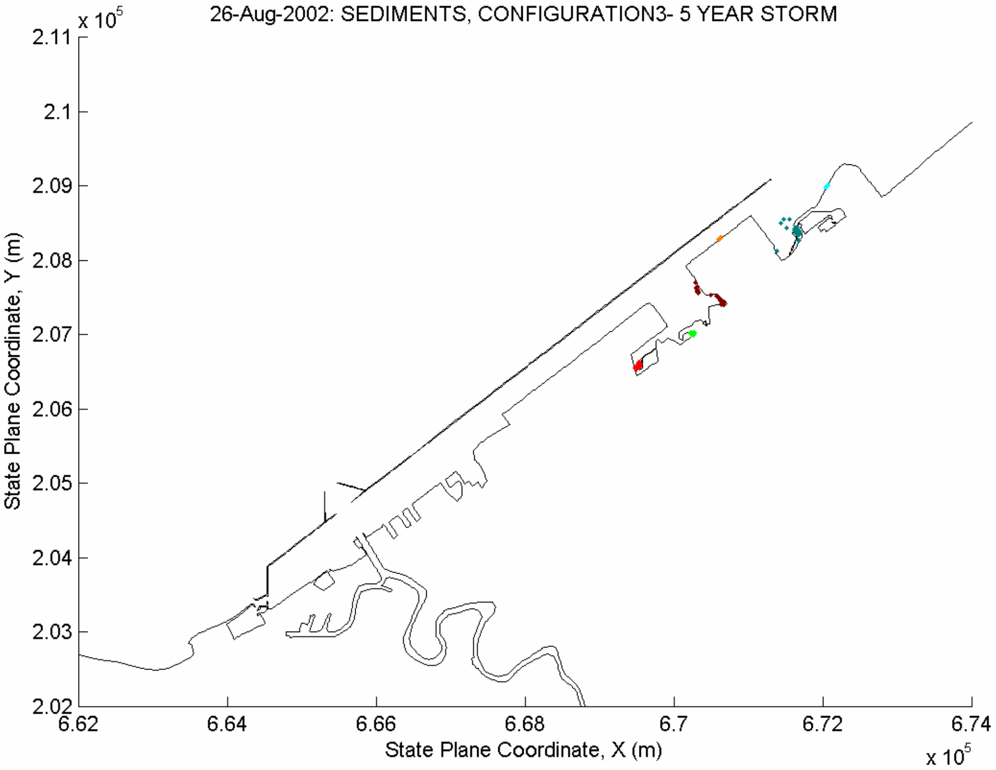
State Plane Coordinate, X (m)
x 10^5



26-Aug-2002: SEDIMENTS, CONFIGURATION3- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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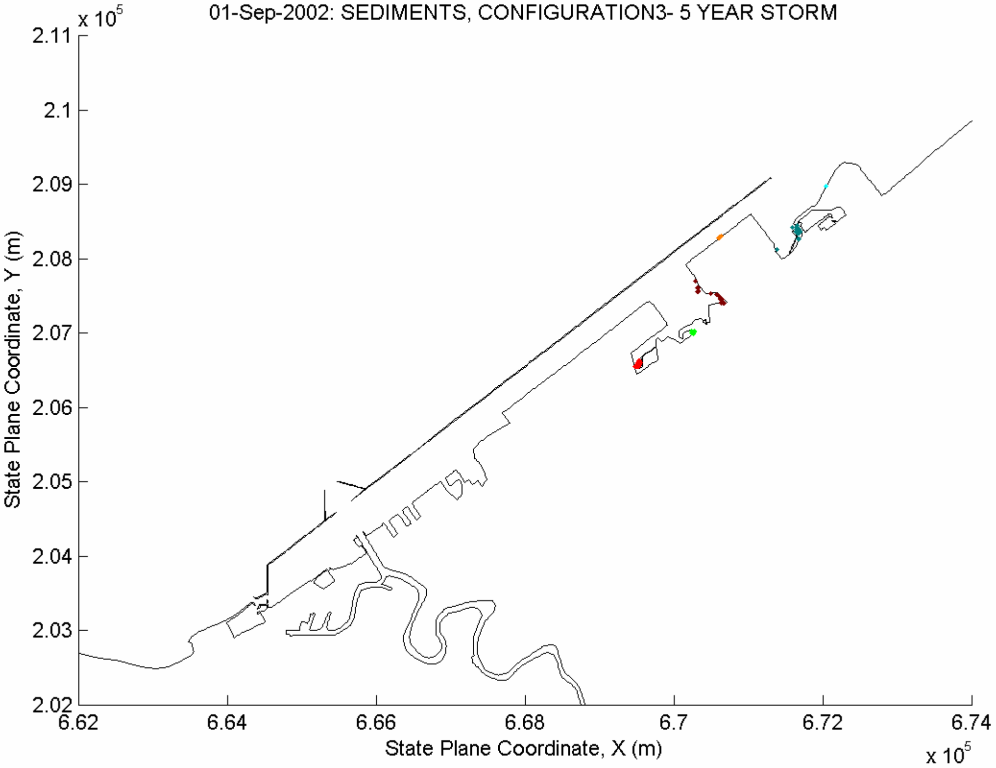
State Plane Coordinate, X (m)
x 10^5



01-Sep-2002: SEDIMENTS, CONFIGURATION3- 5 YEAR STORM
x 10^5
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State Plane Coordinate, Y (m)
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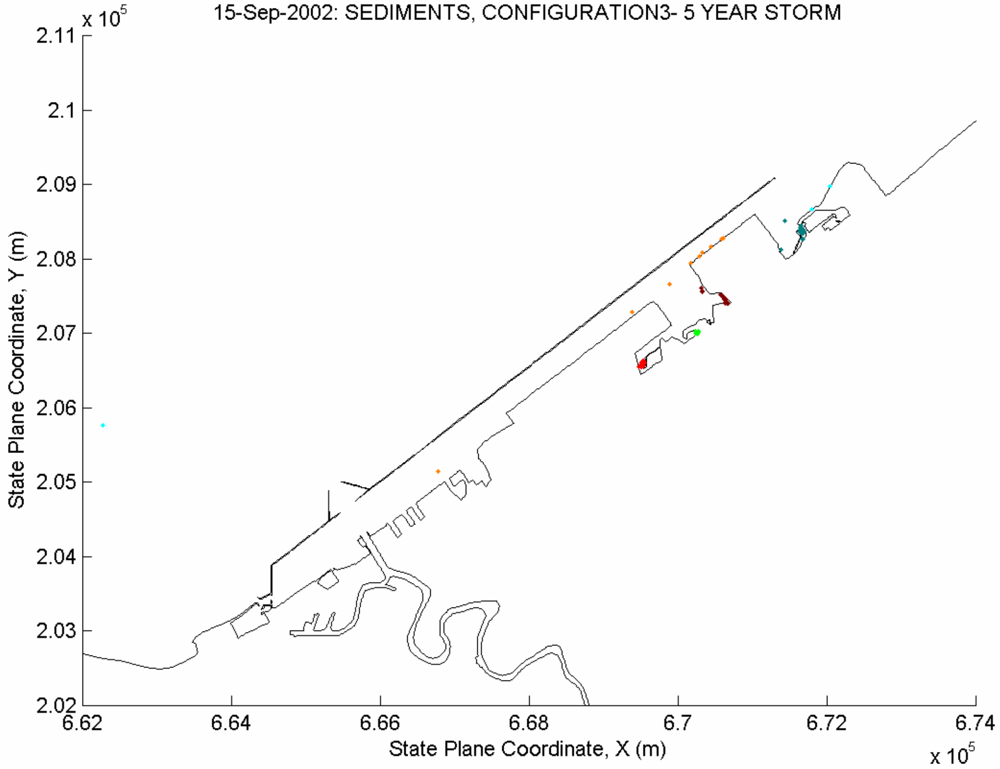
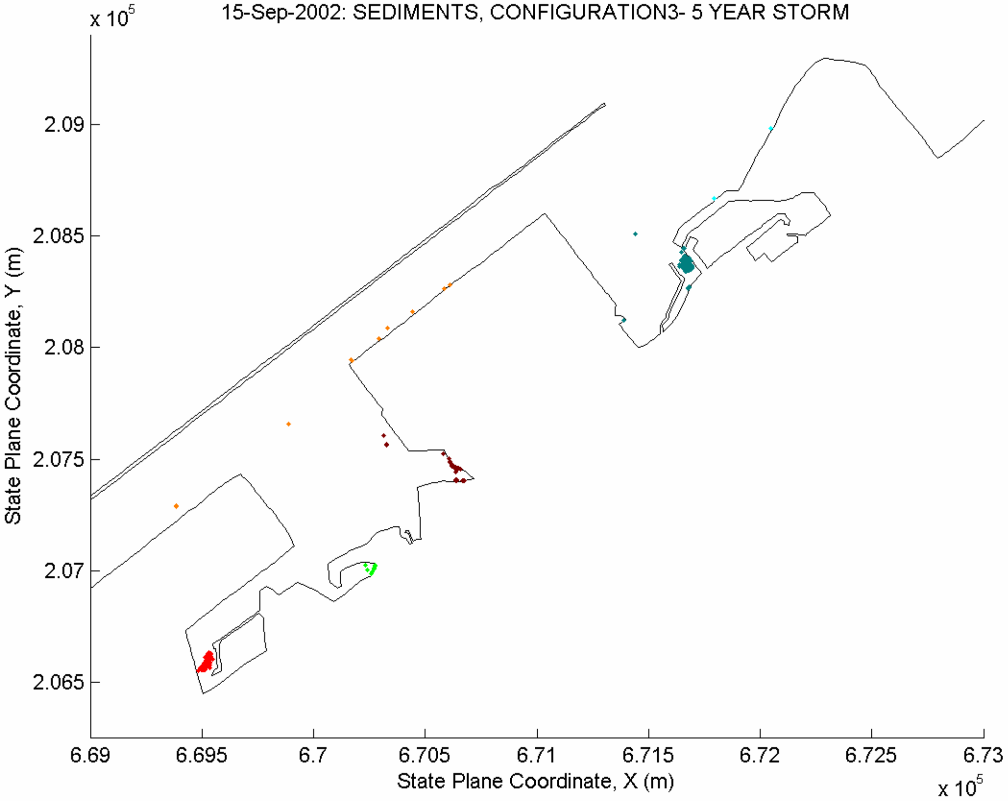
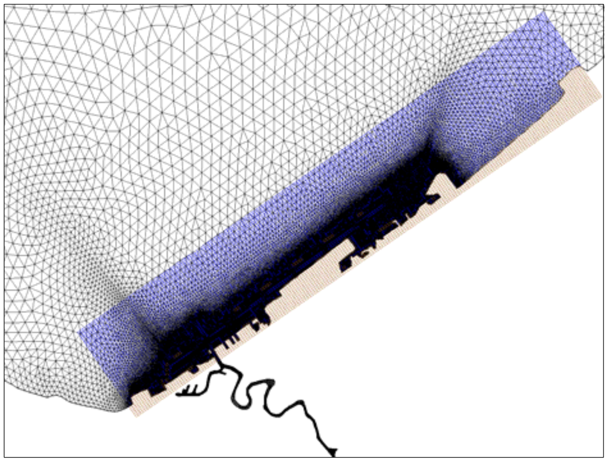
State Plane Coordinate, X (m)
x 10^5


15-Sep-2002: SEDIMENTS, CONFIGURATION3- 5 YEAR STORM
x 10^5
2.11
2.1
2.09
2.08
2.07
2.06
2.05
2.04
2.03
2.02
State Plane Coordinate, Y (m)
6.62
6.64
6.66
6.68
6.7
6.72
6.74
State Plane Coordinate, X (m)
x 10^5

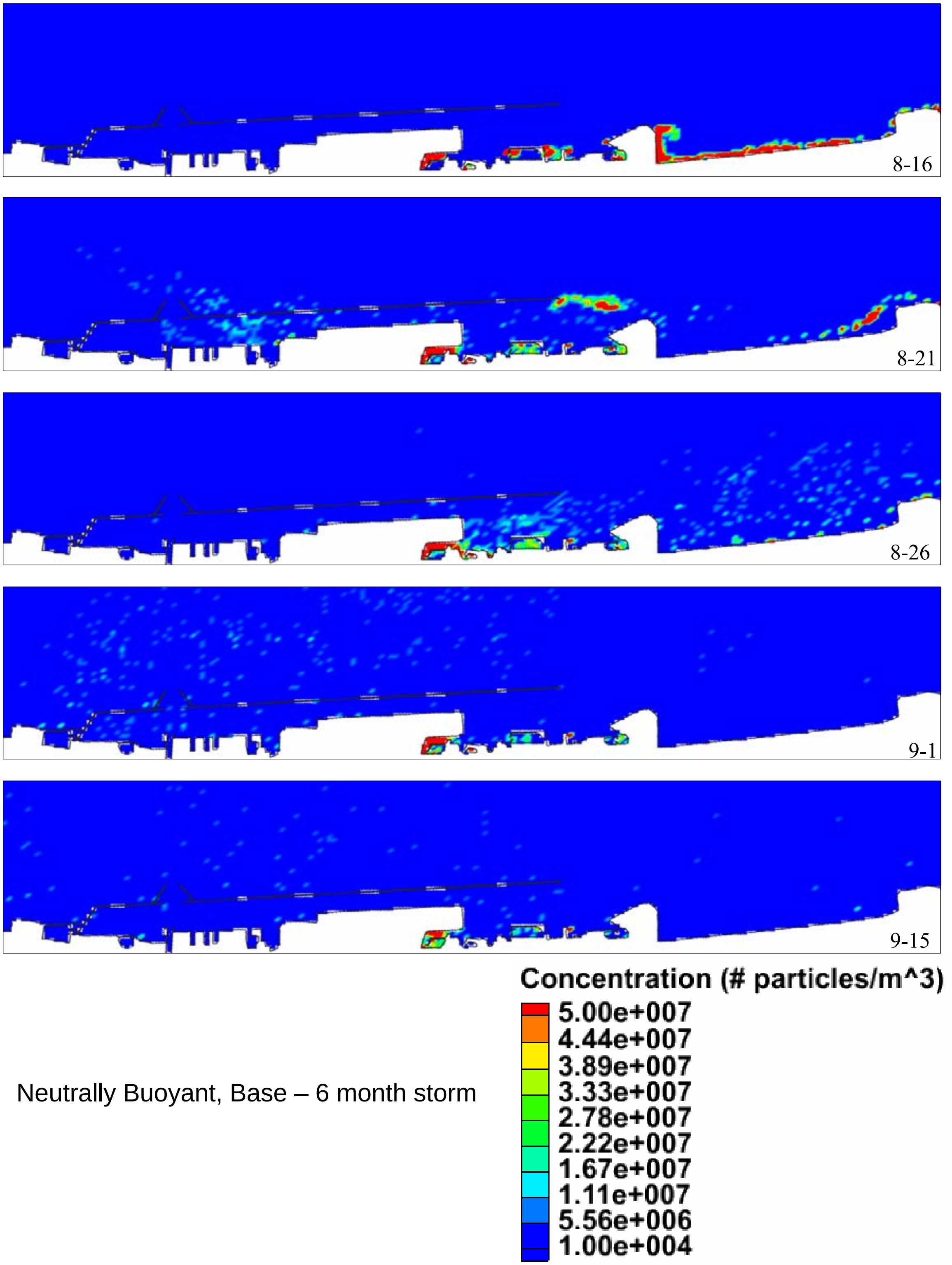

15-Sep-2002: SEDIMENTS, CONFIGURATION3- 5 YEAR STORM
x 10^5
2.09
2.085
2.08
2.075
2.07
2.065
State Plane Coordinate, Y (m)
6.69
6.695
6.7
6.705
6.71
6.715
6.72
6.725
6.73
State Plane Coordinate, X (m)
x 10^5

Appendix C: Concentration

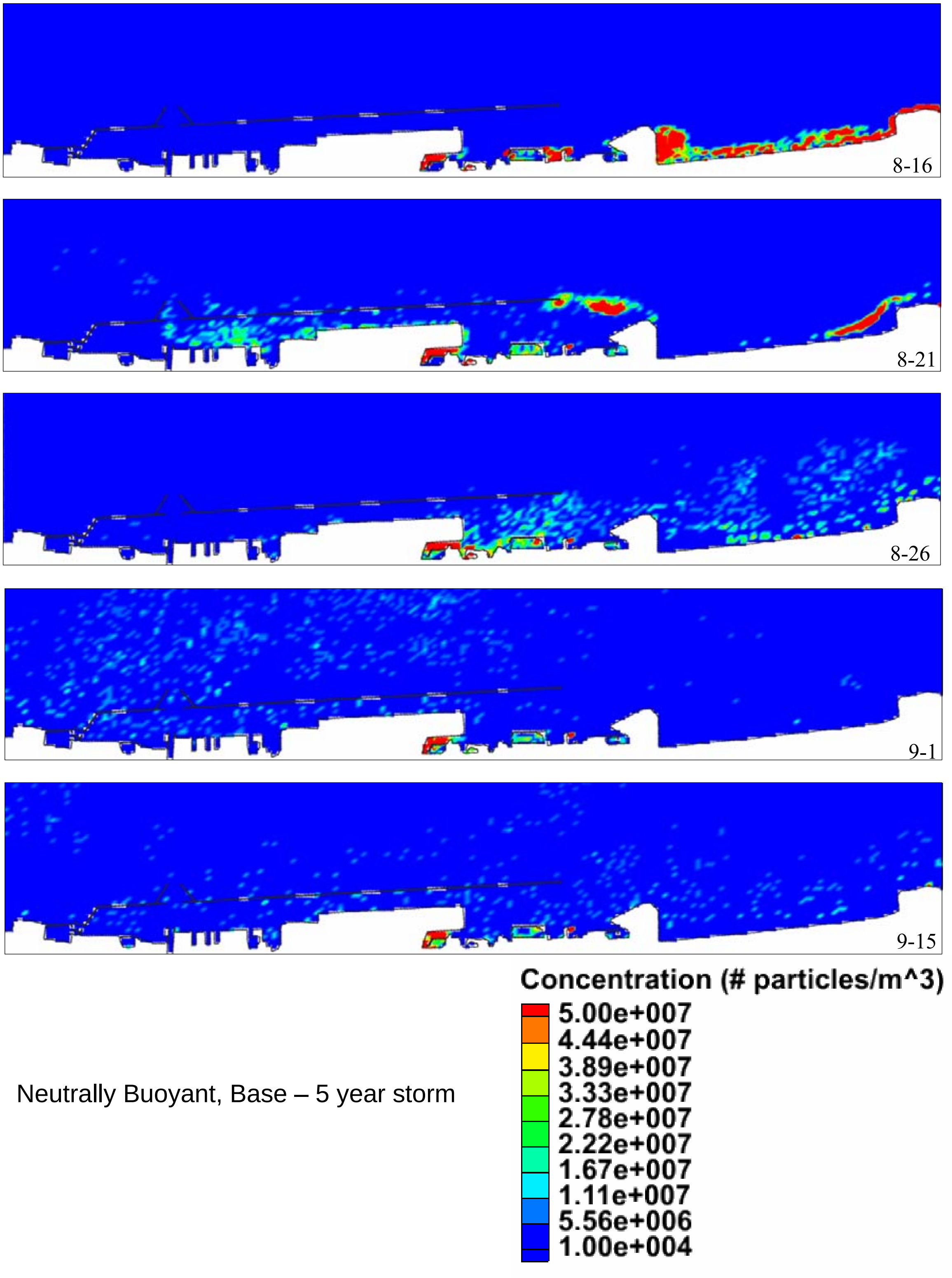


The representation above is the domain of the mesh with the grid used for subsequent concentration calculations.

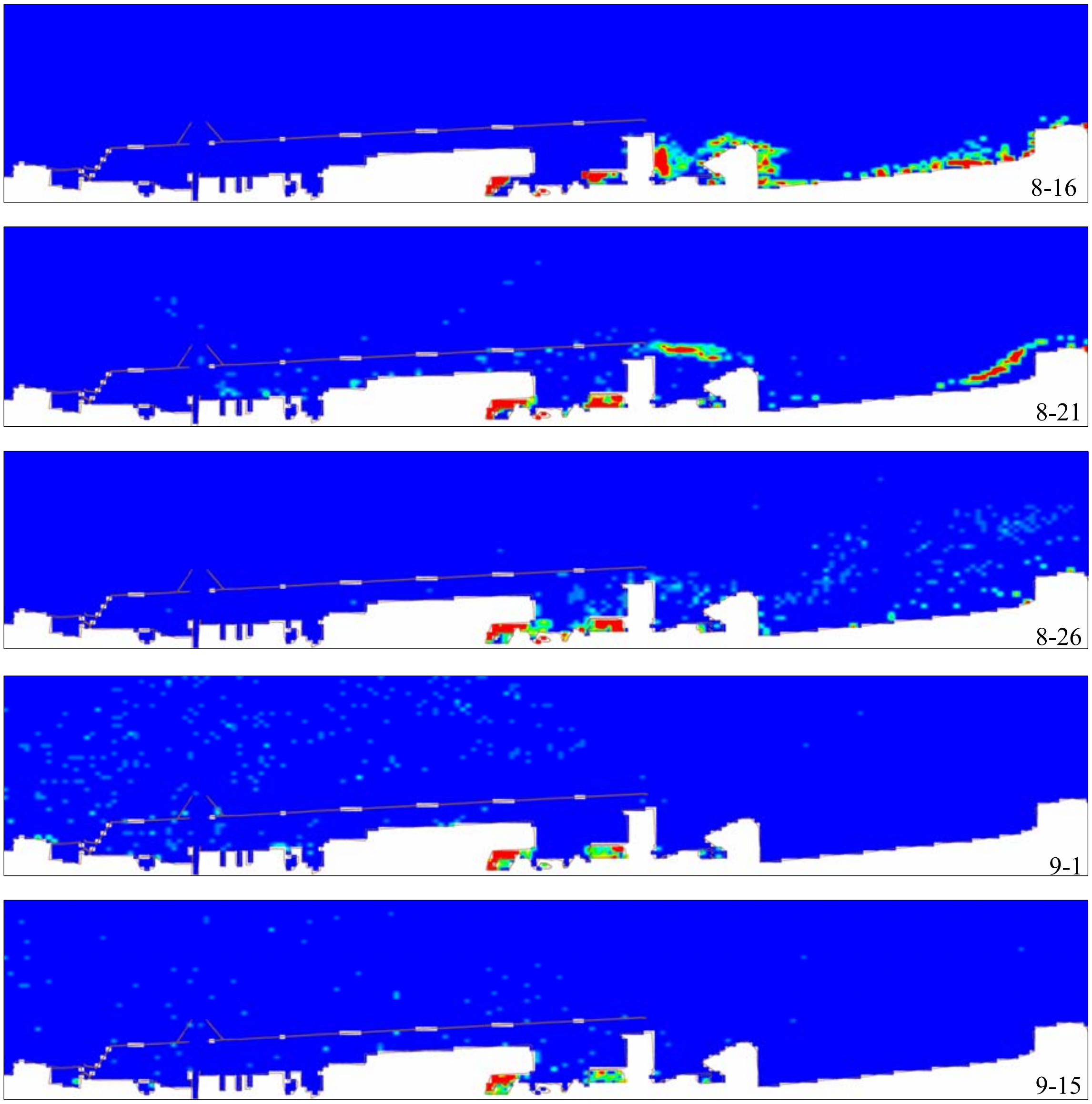
The figures are arranged by particle type, geometry and hydrodynamics. There are two particle types used, neutrally buoyant, and sediments. There are four different geometry types that are used and they are the base condition, configuration 1, configuration 2, and configuration 3. The hydrodynamics was used for 6 month and 5 years storms. Each particle type has a geometry and hydrodynamics representation.



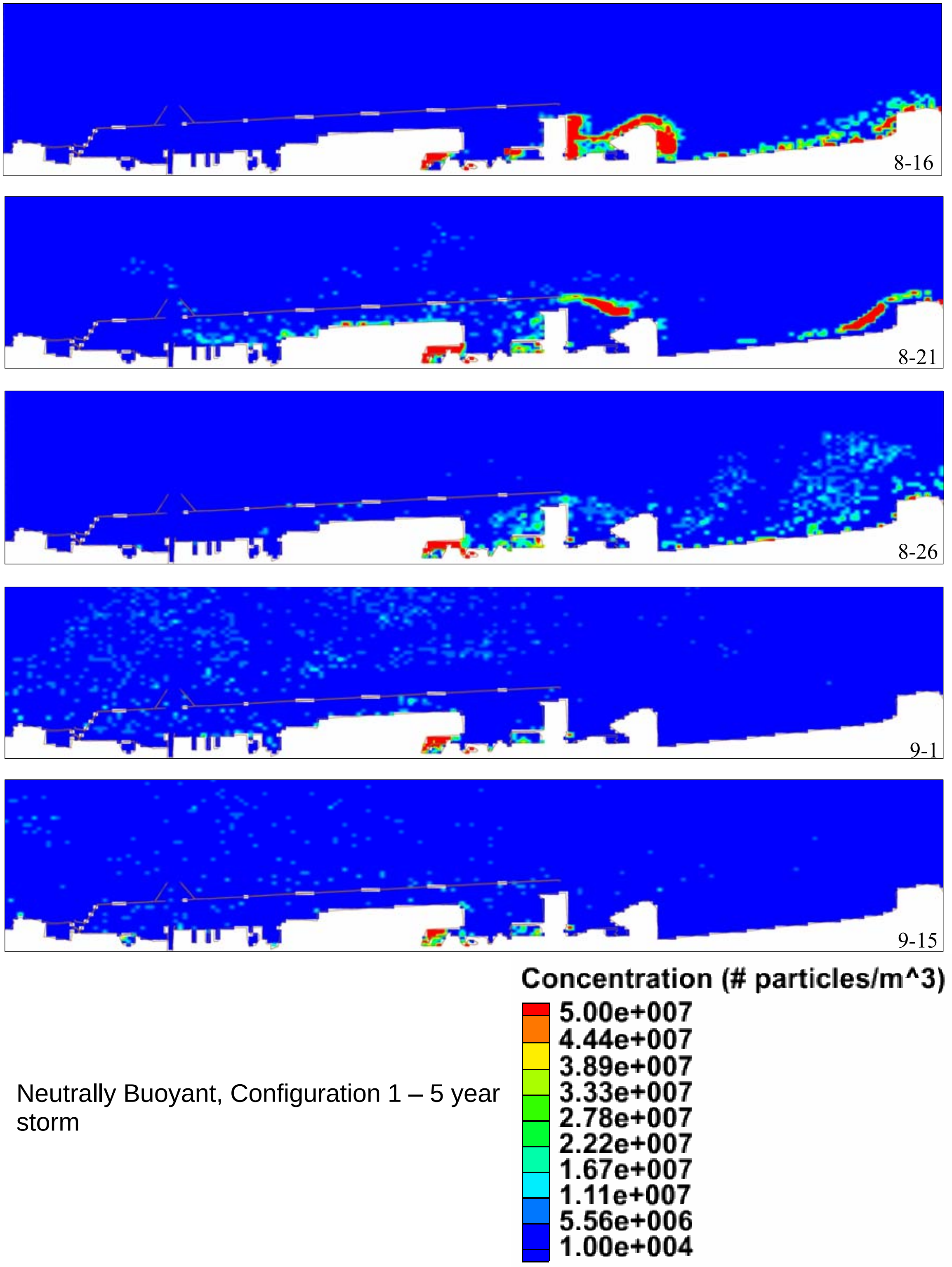
Neutrally Buoyant, Base – 6 month storm



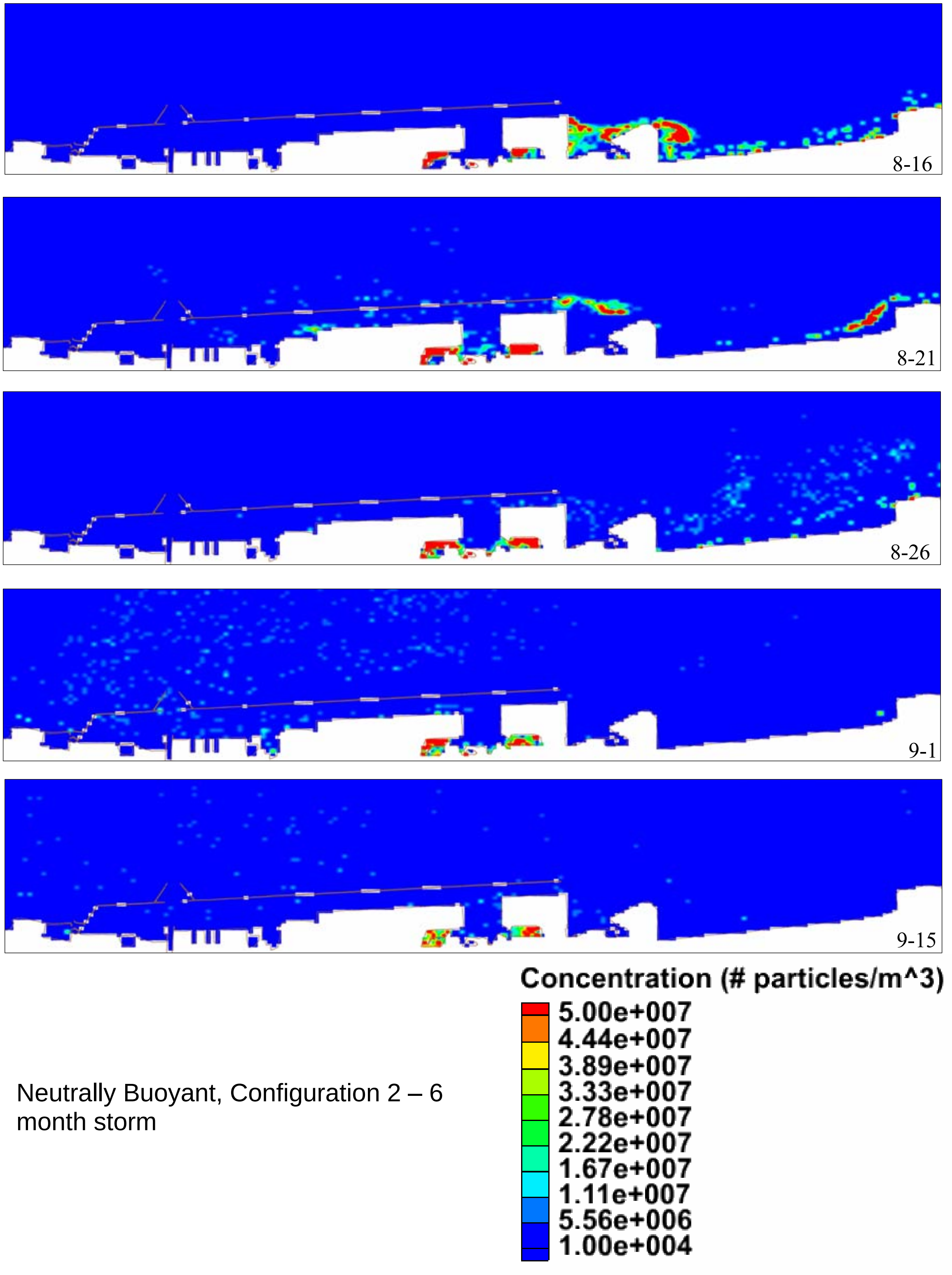
Neutrally Buoyant, Base – 5 year storm



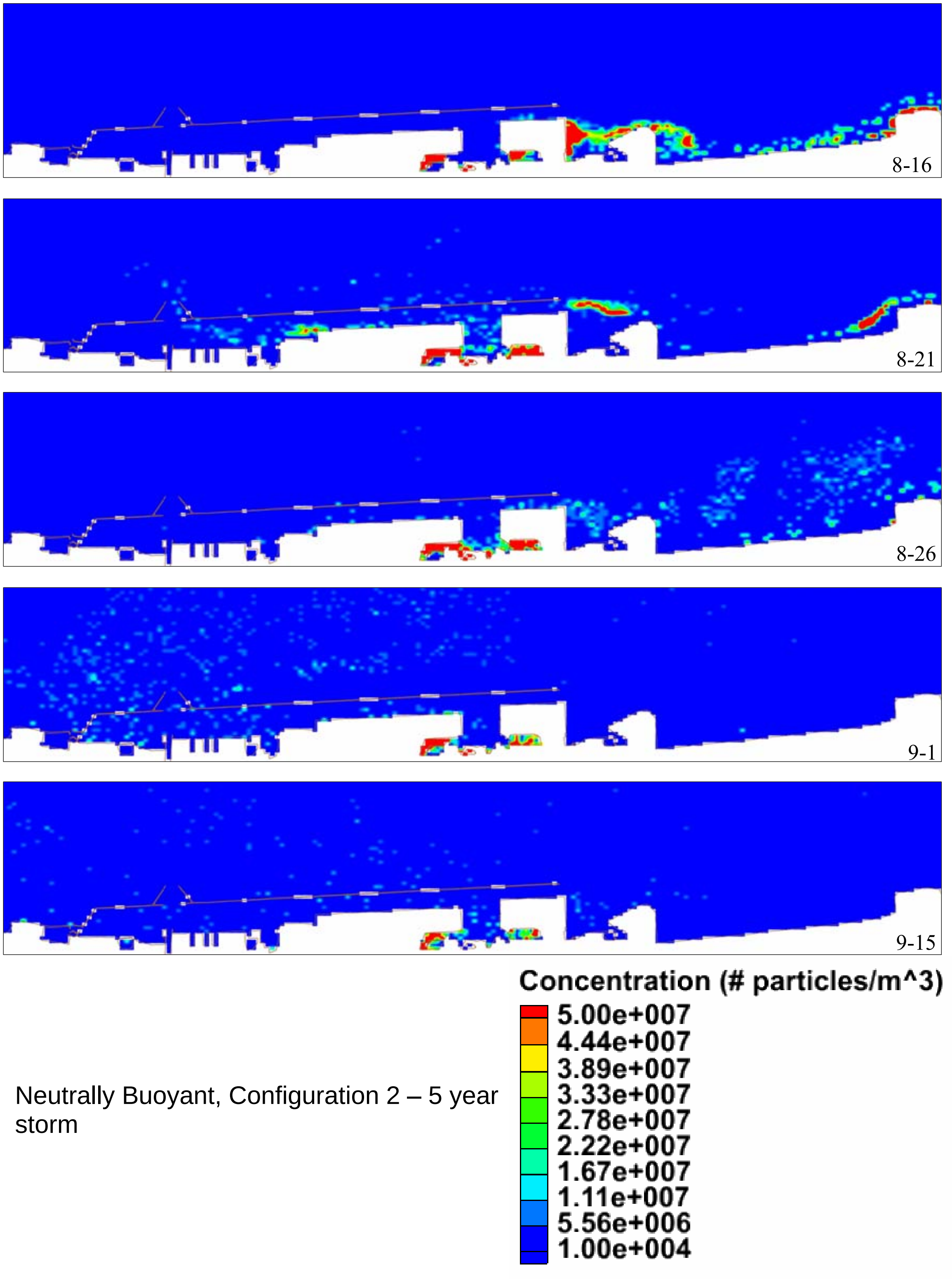
Neutrally Buoyant, Configuration 1 – 6 month storm



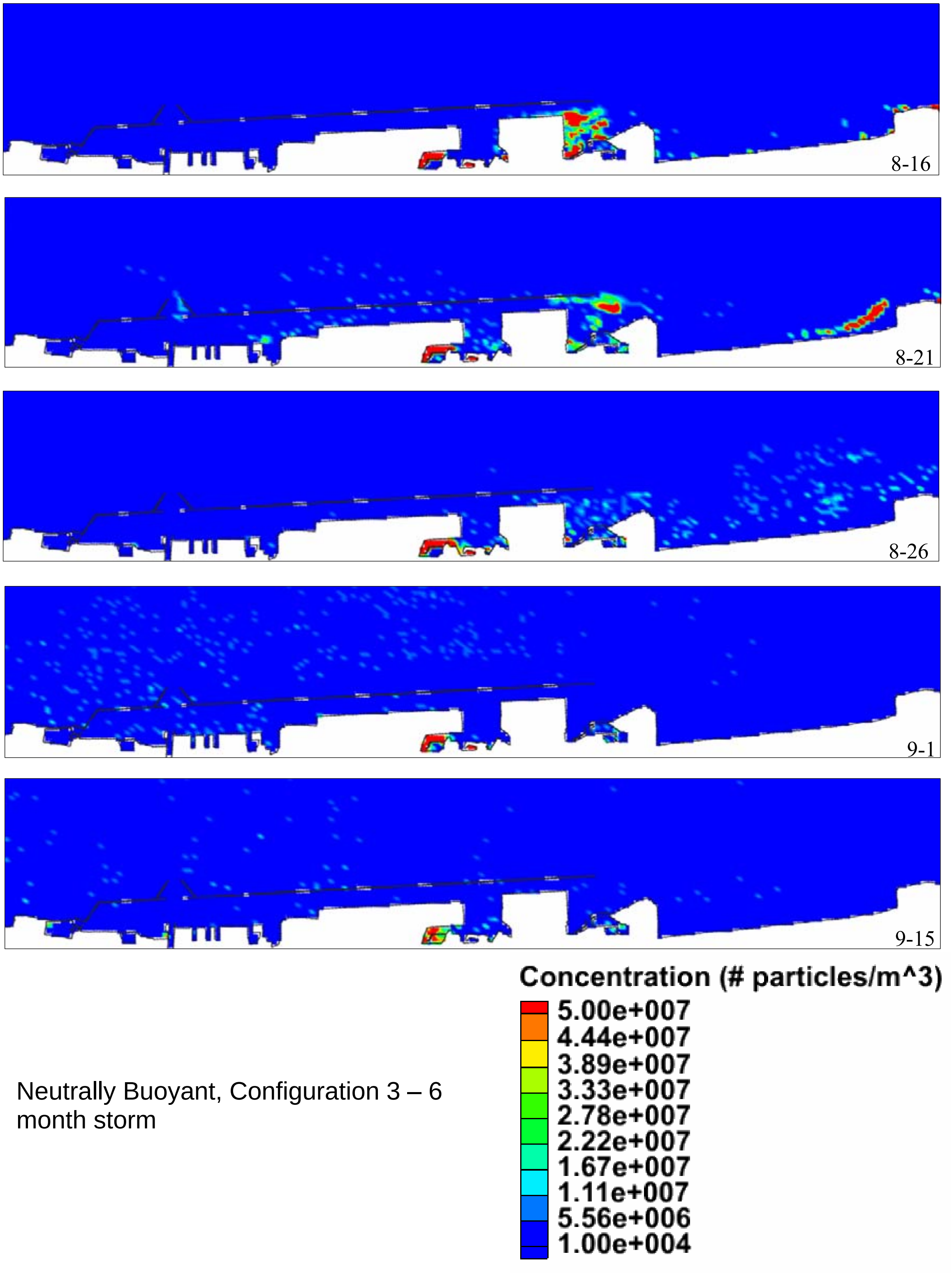
Neutrally Buoyant, Configuration 1 – 5 year storm



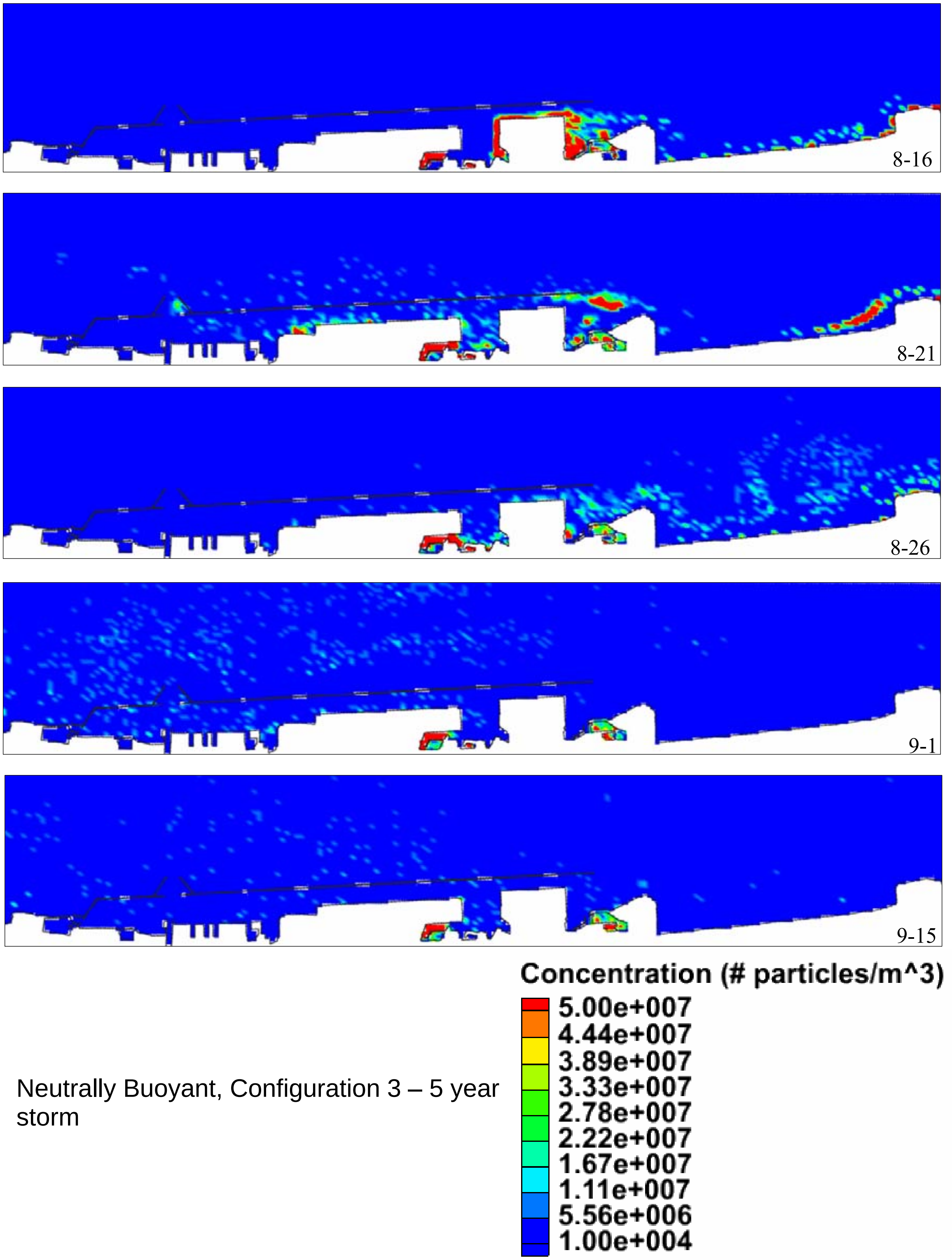
Neutrally Buoyant, Configuration 2 – 6 month storm



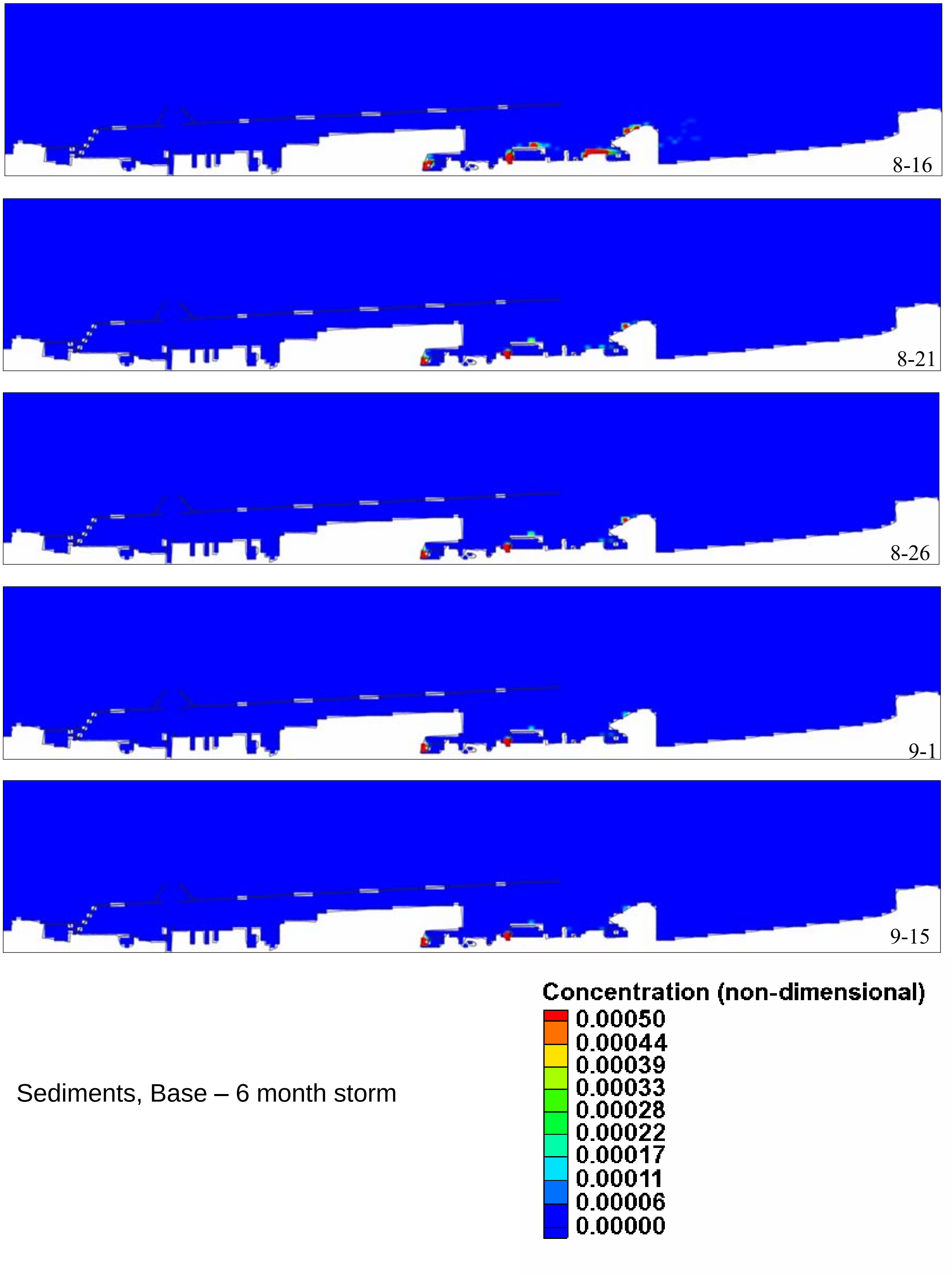
Neutrally Buoyant, Configuration 2 – 5 year storm



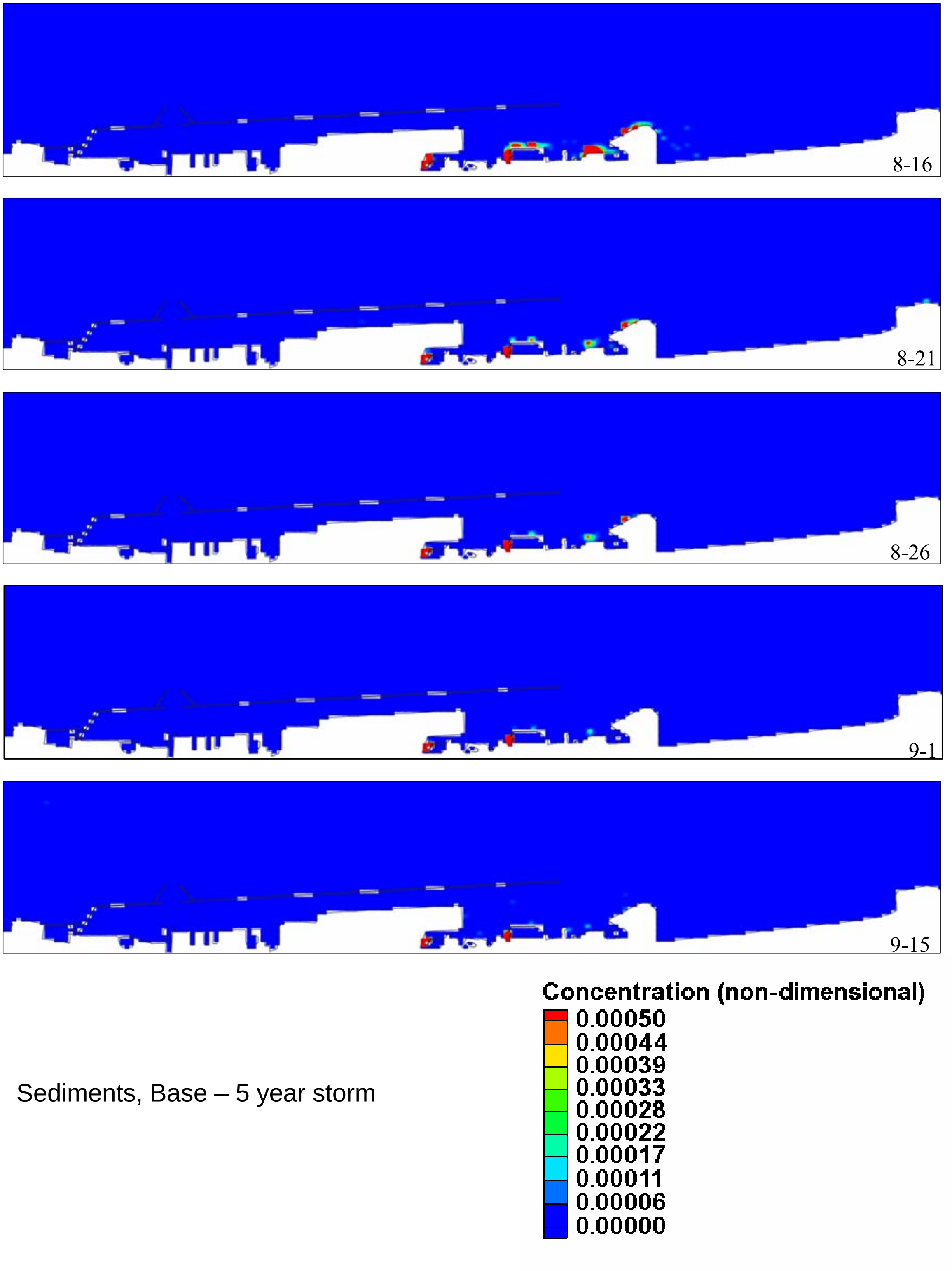
Neutrally Buoyant, Configuration 3 – 6 month storm



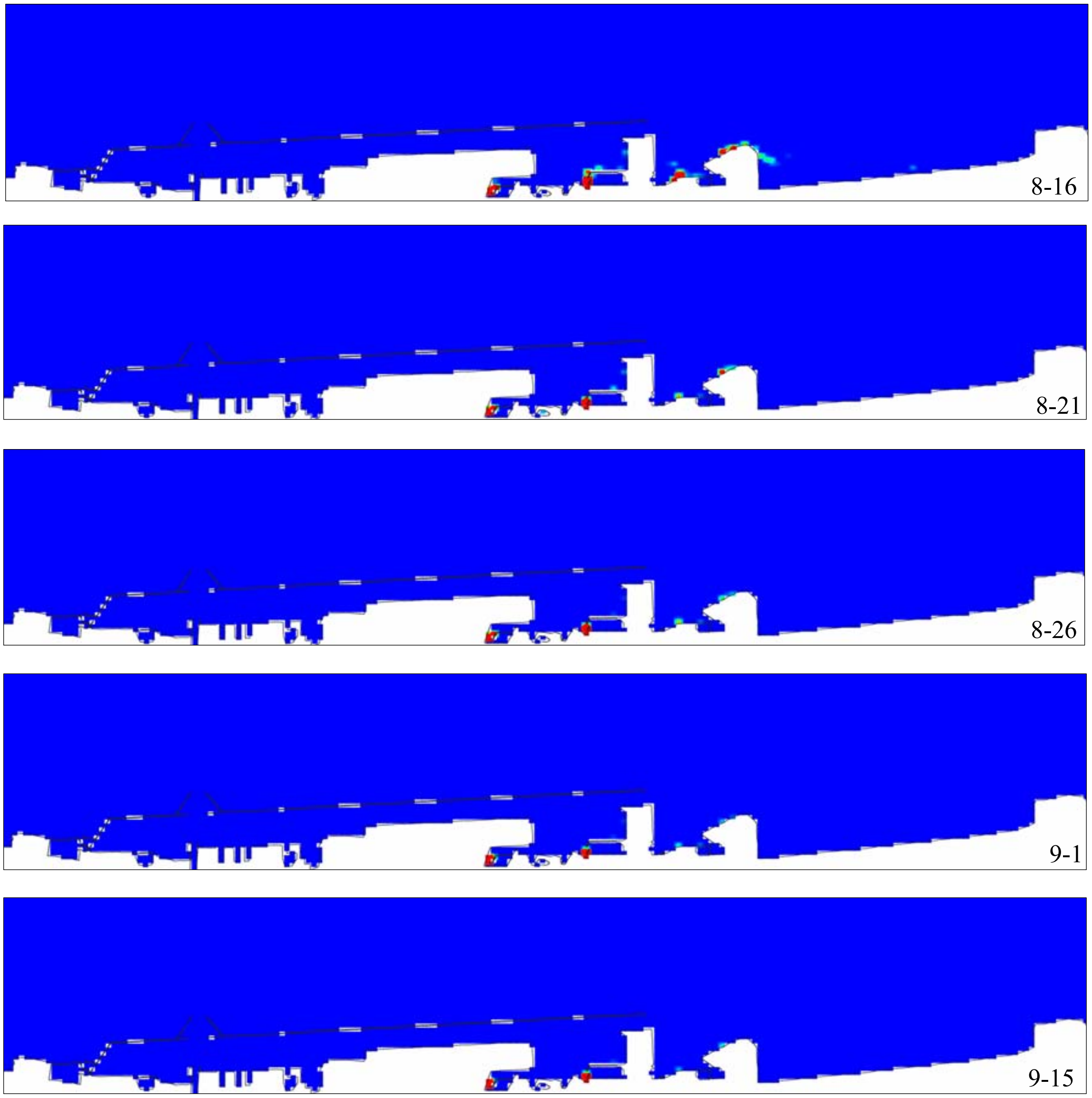
Neutrally Buoyant, Configuration 3 – 5 year storm



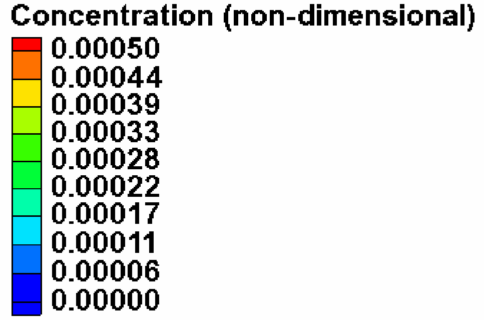
Sediments, Base – 6 month storm

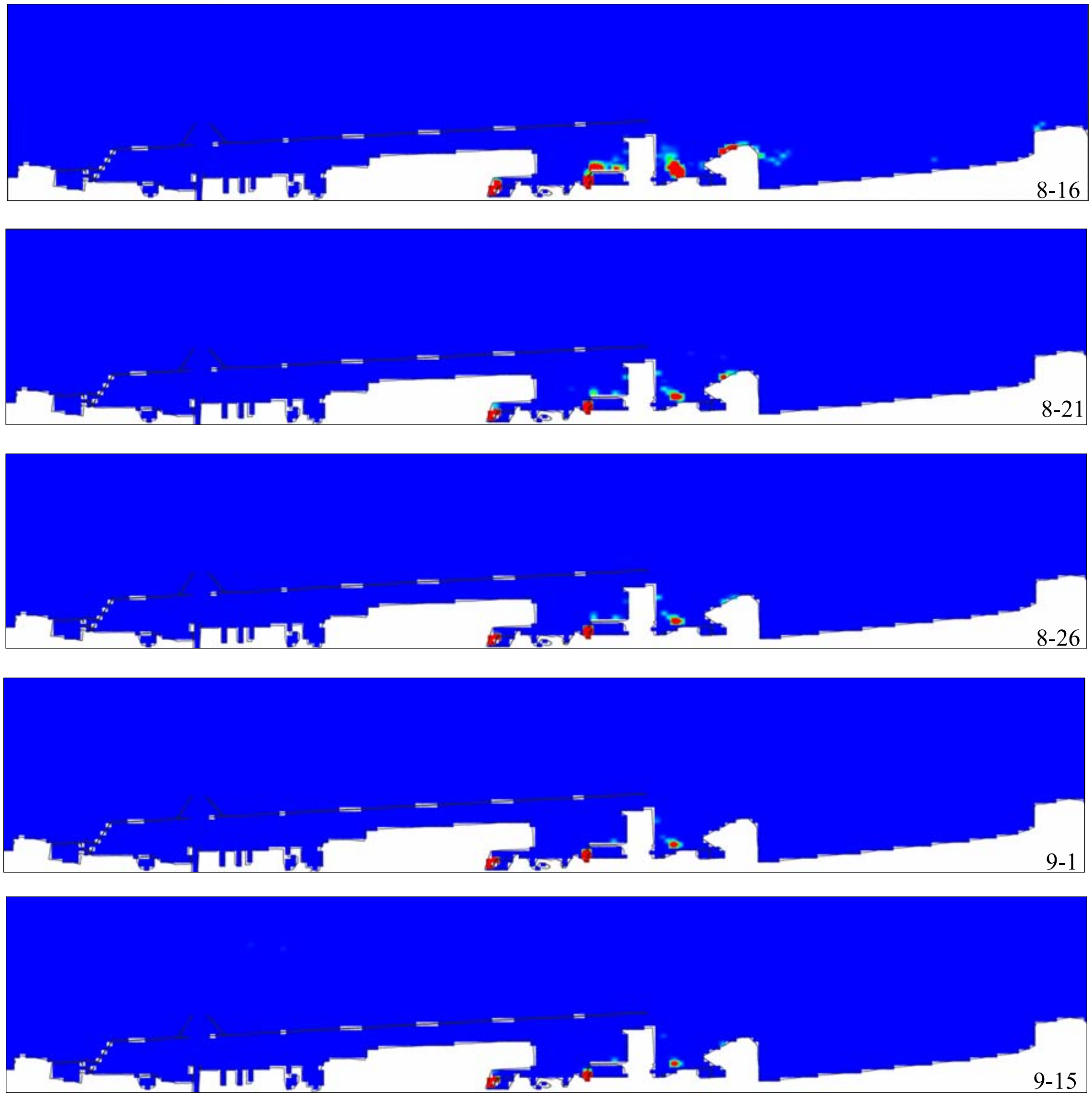


Sediments, Base – 5 year storm

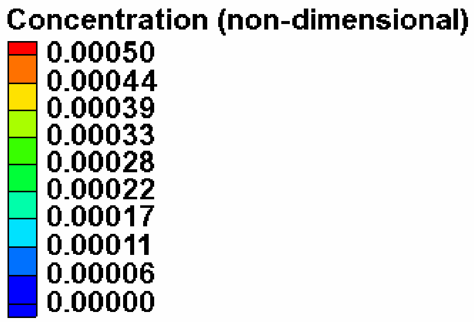


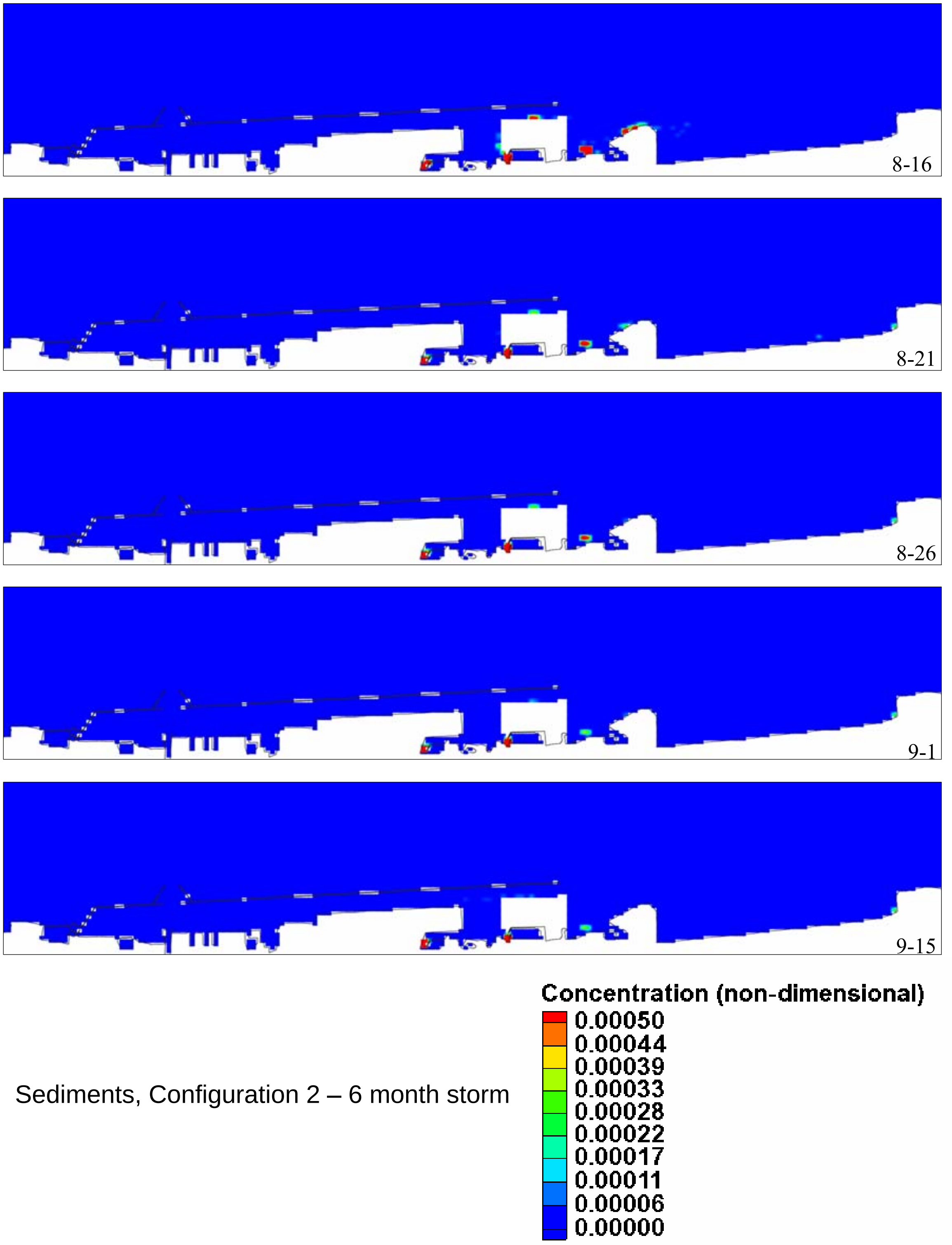
Sediments, Configuration 1 – 6 month storm



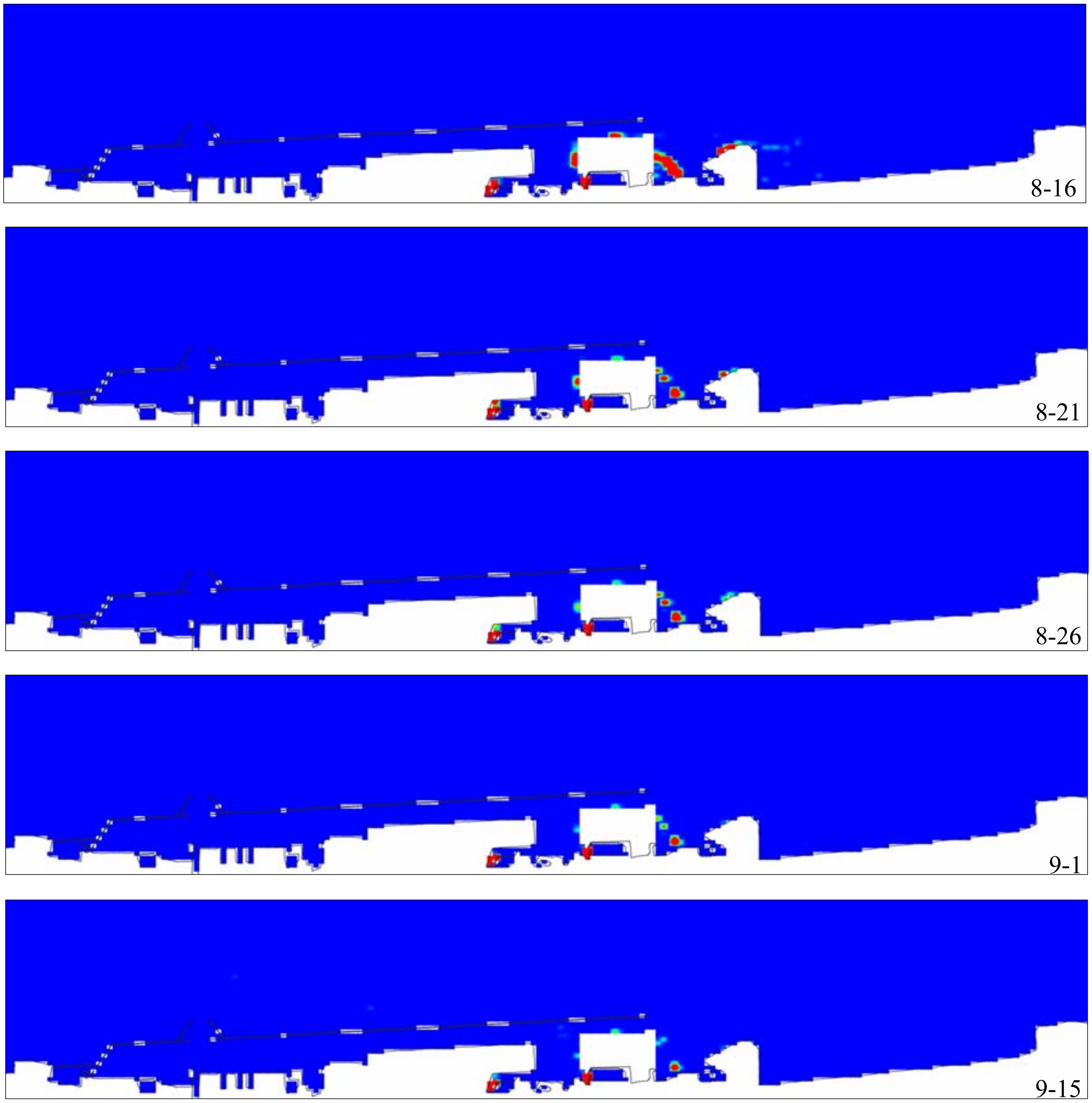


Sediments, Configuration 1 – 5 year storm

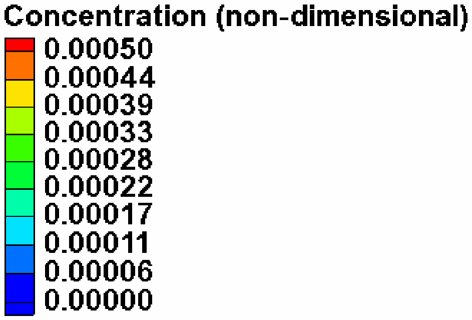


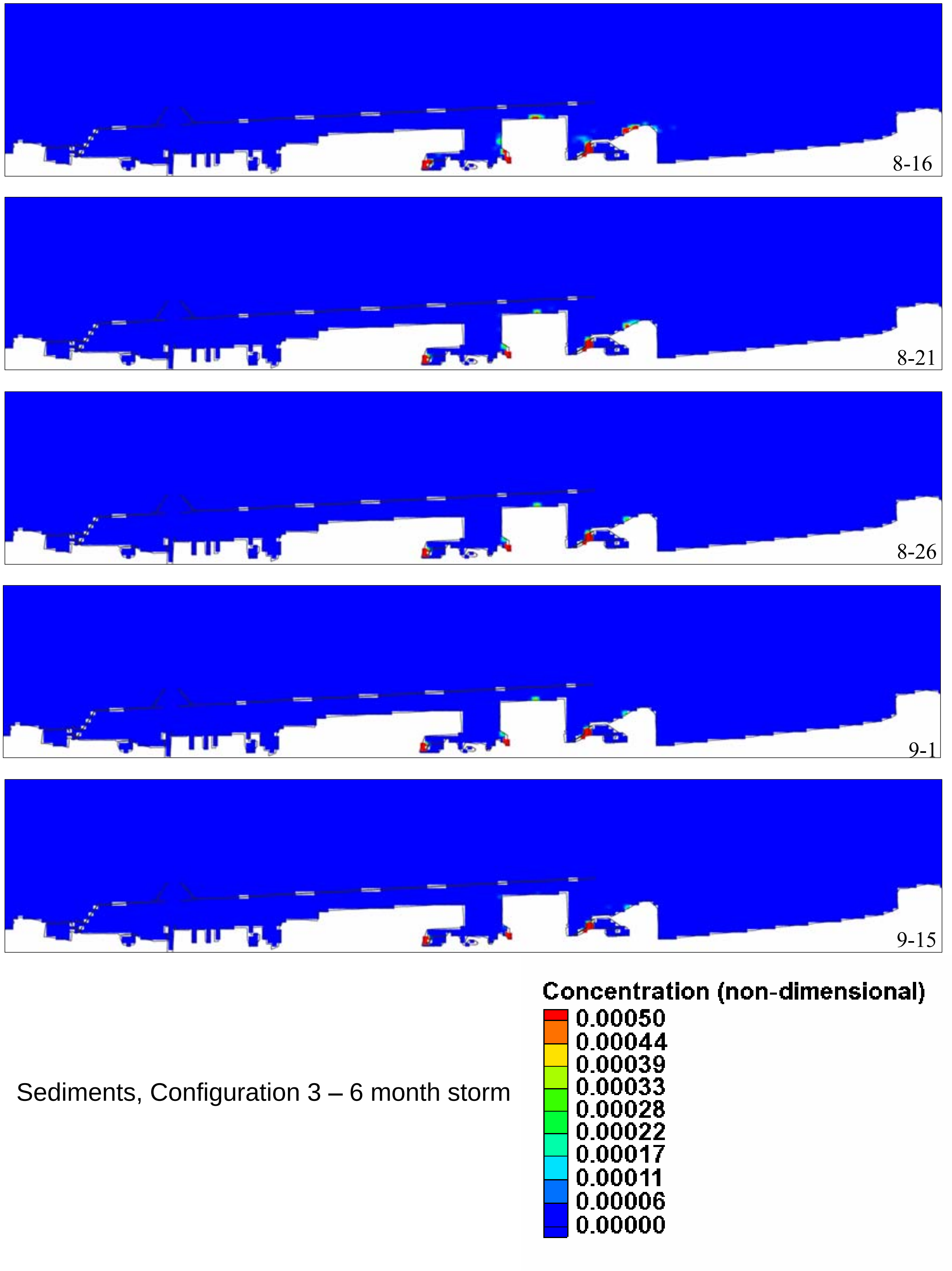


Sediments, Configuration 2 – 6 month storm

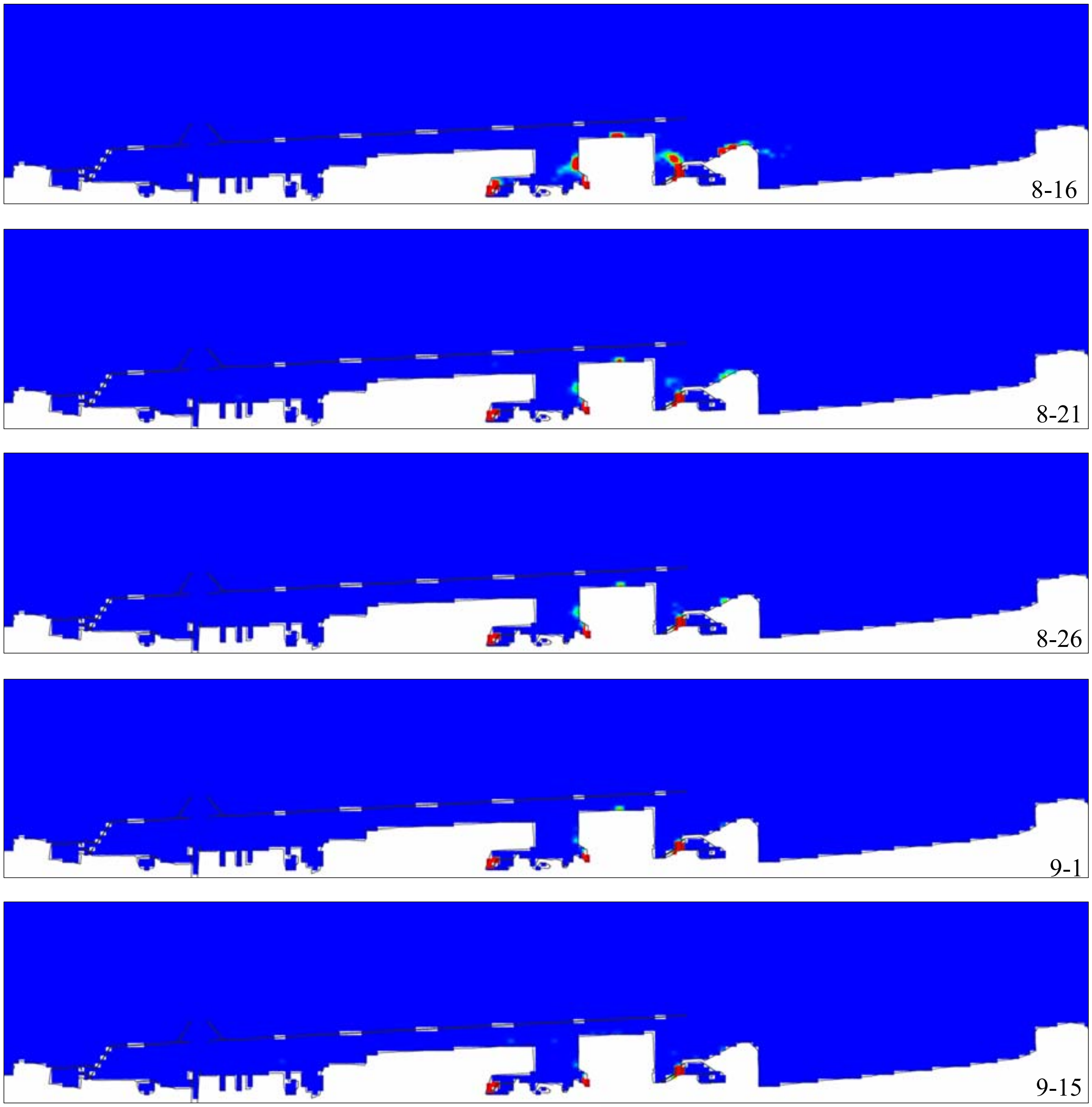


Sediments, Configuration 2 – 5 year storm





Sediments, Configuration 3 – 6 month storm



Sediments, Configuration 3 – 5 year storm

Sediment Transport Potential

A screening level approach has been applied to assess changes to sediment transport pathways for eroded bed sediments induced by proposed CDF configurations. In addition, changes to erosion/deposition patterns over the entire domain are also assessed. The sediment transport potential model GTRAN applied currents calculated by ADCIRC to predict transport magnitudes and pathways in the study area. GTRAN is a point model, which estimates potential transport and does not solve continuity of mass, i.e., it is a local transport model and it assumes unlimited sediment is available in the bed. GTRAN can include effects of waves as well as current on transport of non-cohesive sediment. However, since wave modeling was not part of the scope of work, only circulation parameters are provided to GTRAN through the external simulations with ADCIRC. GTRAN equations are applicable for coarse silt through all sand sizes. Although Cleveland Harbor is generally fine grained, transport pathways should still be well represented by GTRAN.

From input hydrodynamics and sediment bed conditions, GTRAN calculates sediment bed erosion rate as well as transport direction and magnitude through a collection of sediment transport methods. GTRAN automatically selects the appropriate transport method based on hydrodynamic conditions. Only one transport method was applied (van Rijn, 1984) for the Cleveland Harbor simulations because the harbor is current dominated and van Rijn is the appropriate method for these regimes. A description of the GTRAN sediment transport methods, including sediment transport equations, follows in the next section. GTRAN is a screening level model. Therefore, sediment transport potential calculations include simplifying assumptions and representations of the natural processes. Making such assumptions is standard practice in the field of numerical modeling and is not unique to sediment transport models. The following discussion of the approximations used for estimating transport rates using the van Rijn method is limited to general descriptions of the approximations applied.

It should be noted that all sediment transport methods, including van Rijn, applied in GTRAN are for non-cohesive sand and coarse silt (non-cohesive sediment). Cleveland Harbor sediments are finer than the range for which the van Rijn method is developed. However, the theory can be applied to assess relative magnitude of erosion potential for with and without project conditions. This is how GTRAN is applied in this study. Also, transport theories are available for non-cohesive sediment, but not for finer, cohesive sediment. Cohesive sediment erosion and transport is influenced my numerous, inter-dependent properties. Available transport algorithms require site-specific parameterization. This parameterization was outside this study scope.

Van Rijn current-dominated transport method

The van Rijn (1984) current-only total transport method was parameterized from van Rijn's comprehensive theory of sediment transport in rivers. Although the method was developed for sediment transport in the riverine environment, the method may also be appropriately applied in the marine environment under conditions for which waves contribute little to the bottom shear stress. The simpler, parameterized formulae approximate the full theory within ±25 percent and were developed for water depths less than 20 m, velocities between less than 5 m/s, and d_{50} between 0.1 and 2 mm. The resulting parameterized method estimates transport by the following simpler formulation:

$$q_t = q_b + q_s \tag{1}$$

$$q_b = 0.005\bar{U}h\left\{\frac{\bar{U}-\bar{U}_{cr}}{\left[(s-1)gd_{50}\right]^{1/2}}\right\}^{2.4}\left(\frac{d_{50}}{h}\right)^{1.2} \tag{2}$$

$$q_s = 0.012\bar{U}h\left\{\frac{\bar{U}-\bar{U}_{cr}}{\left[(s-1)gd_{50}\right]^{1/2}}\right\}^{2.4}\left(\frac{d_{50}}{h}\right)\left(D_*\right)^{-0.6} \tag{3}$$

where:

$$\begin{aligned}\bar{U}_{cr} &= 0.19\left(d_{50}\right)^{0.1}\log_{10}\left(\frac{4h}{d_{90}}\right) \text{ for } 0.1 \le d_{50} \le 0.5\,mm\\ \bar{U}_{cr} &= 8.50\left(d_{50}\right)^{0.6}\log_{10}\left(\frac{4h}{d_{90}}\right) \text{ for } 0.5 \le d_{50} \le 2.0\,mm\end{aligned} \tag{4}$$

$$D_* = \left|\frac{g(s-1)}{\upsilon^2}\right|^{1/3} d_{50} \tag{5}$$

q_t=total transport
q_b=bedload transport
q_s=suspended load transport
$\bar{U}$ = depth-averaged current
h = water depth
s = specific gravity of sediment
g = acceleration due to gravity
d_{50} = median grain diameter
d_{90} = sediment diameter for which 90 percent is finer by weight
ν = kinematic viscosity

Transport modeling

GTRAN is a point model, and it requires X, Y, and Z coordinates for each location where sediment transport magnitude and direction are calculated. The computational domain for GTRAN was defined by 2805 to 2842 discrete points spaced at 150 m. The number of points and spacing were selected so that there were sufficient points to define transport patterns in Cleveland Harbor, particularly near the proposed CDF. The GTRAN model was driven by currents obtained from ADCIRC circulation model results of 6-month and 5-year storms. Waves were not modeled as part of this scope of work; therefore, transport results were obtained by the van Rijn current-only method. GTRAN input includes bed grain size, bathymetry, and hydrodynamic/environmental conditions.

With the initial bed conditions specified, the model distributes environmental forcing conditions from ADCIRC large-domain circulation model to each of the computational points. The temporal resolution of the current information is 30 min. This resolution is adequate to define the temporal changes in current conditions for representing sediment transport. With local conditions determined, the model proceeds to estimate the current-related bottom shear stresses and to estimate the depth of the active sediment layer. The active sediment layer is defined as the depth of the sediment bed that is mobilized by sediment suspension and bed-load movement.

GTRAN calculates the total sediment transport magnitude and direction for each time step at each point. Direction (in degrees) is used to classify the transport into one of 20 directional bins. Each bin covers 18 degrees. Bins are centered on 0, 18, 36, 54, deg, etc. Transport rate is summed within each bin for the entire simulation length (six weeks) to calculate total transport rate for each defined bin over an event.

An example rose plot is given in Figure 1 with the corresponding values listed in Table 1. The figure shows transport with different magnitudes in bins 0 to 54 deg and 180 to 252 deg, with no transport reported in the remaining bins. This example shows transport in the northeast and southwest quadrants. It should be noted that the values shown in Figure 1 and Table 1 are given as an example and does not apply to the present study.

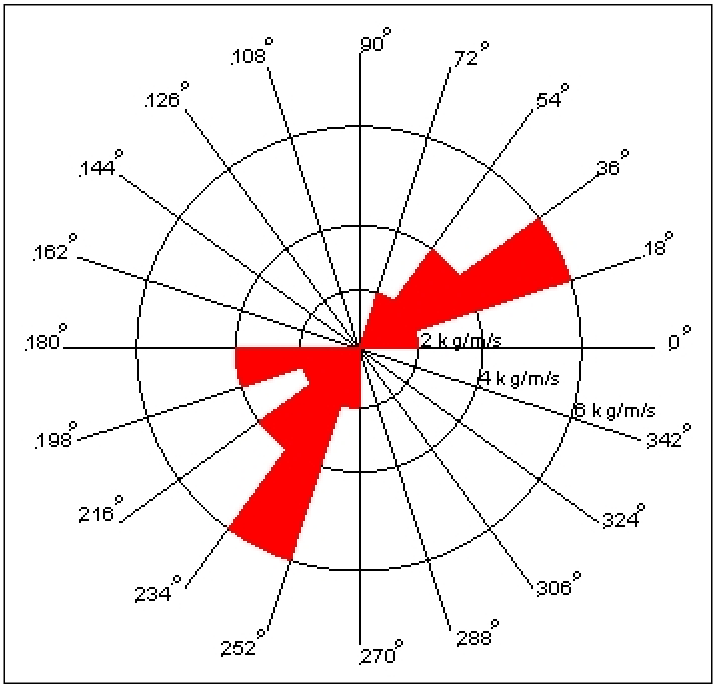


Figure 1. Example or rose plot direction and magnitude bins

Table 1: Rose Plot Angle and Magnitude Example

Angle (deg)	Magnitude (kg/m/s)
0 - 18	2
18 - 36	6
36 - 54	4
54 - 72	2
72 - 90	0
90 - 108	0
108 - 126	0
126 - 144	0
144 - 162	0
162 - 180	0
180 - 198	4
198 - 216	2
216 - 234	4
234 - 252	6
252 - 270	0
270 - 288	0
288 - 306	0
306 - 324	0
324 - 342	0
342 - 360	0

Transport results were calculated for three sediment diameters; d_{50} = 0.07, 0.10 and 0.20 mm for each event (six month and 5 year) and are presented as rose plots (directional distribution of transport) in Appendix C.

GTRAN Model Results

Results from GTRAN in the study area for the base condition with the 6-month storm and all three grain diameters are shown in the rose plots of Figures C1 through C3. Each red “wedge” in these figures represents transport for one of the 20 bin directions at each point. Area of the red colored wedge indicates relative transport potential. Therefore, the large wedges indicate high transport in a specific direction while small wedges indicate very small amounts of transport. GTRAN is generally used to look at relative transport and transport pathways and is not indicative of net transport because it does not account for deposition. Wedge areas are used to demonstrate relative magnitude of transport over a domain and transport pathways in a system. The model is successfully applied to identify transport trends in active regions. Unfortunately, Cleveland Harbor is a low energy environment with sand erosion occurring only in isolated areas, as shown in Figures C1-C3. Additional red wedges would be present nearshore and outside the breakwater if waves were included in the storm erosion/transport estimates. The only transport observed occurs off the north side of Dike 14 and transport is generally unidirectional. Similar results are shown for the 5-year storm in Figures C4 through C6. These figures show that current-generated stresses are insufficient to entrain and transport sediment within the harbor for any of the grain sizes simulated. As previously stated, wave-induced erosion is not included, so there is zero transport along much of the shoreline outside the harbor where waves would significantly contribute to transport. Transport offshore and to the west is exhibited around Dike 14. This is due to seiche-induced currents around this sharp bend.

It should be noted how wave action, not included in this scope, may influence results shown here, especially in the nearshore. Surface waves produce oscillatory flow on the sediment bed. The magnitude of this flow is a function of wave height, wave period, and water depth. The oscillation is symmetric in deep water and asymmetric in shallow water as the wave shoals and moves toward breaking. The orbital velocity is therefore strongest in shallower water. The lack of transport in some nearshore areas outside the breakwater in Figures C1-C6 is due to lack of wave influences in the model application. During storms, waves become larger and can produce transport in deeper water. Net transport under a wave would be zero because of the sinusoidal motion of the particles if currents were not present. In wave/current transport, waves act as a suspension mechanism and currents as the transport mechanism in deeper water. For example, the 5-year storm probably included some significant waves that would have moved sediment outside the breakwater. In the present study, the breakwater shelters the project area so effects of waves are minimal; especially from westerly waves, the predominant wave direction. The potential deposition patterns, discussed in the next section, should be representative of actual conditions in the harbor. Outside the breakwater, storm wave orbital velocity has a significant influence on erosion and transport and more sediment would be kept in suspension.

Identical simulations (6 month and five year event) were performed with project conditions. Results for with and without project conditions were similar in the vicinity of Dike 14. Results for Configuration 1 CDF are shown in Figures C7 through C12.

Although hardly visible in the figures (because of the large transport rates near Dike 14), slight transport is predicted between the proposed CDF and breakwater at one GTRAN point for all grain sizes and both storms (Figures C7 through C12). This demonstrates that the new channel will experience increase energy compared to the without project conditions channel.

Configurations 2 and 3 also showed similar transport in the vicinity of Dike 14 as the base case and Configuration 1 for both storms (Figures C13 through C24). However, no transport was observed between the CDF and the breakwater for these configurations. Configuration 1 estimated minimal transport; currents were slightly reduced in the channel for Configurations 2 and 3, thus eliminating any transport.

Sediment transport results from GTRAN indicated very little erosion and transport of bottom sediments of size 0.07 to 0.20 mm as a result of the proposed CDF plans. Another way to present the results is to observe the transport difference between a proposed configuration and the present (base) condition. Figures C25 through C60 show the increased difference and decreased difference in transport between each configuration and the base condition for each storm and grain size. Wedge size is re-calibrated for these difference plots so that the reader can visualize the differences. Difference plots cannot use the same scale as total transport plots (Figures C1-C24) because transport differences would not be visible in the figures. The figures show increase in transport between the Configuration 1 CDF and breakwater in Figures C25, C27, C29, C31, C33, and C35. It is interesting that transport north of Dike 14 decreases with the 6-month storm and increases with the 5-year storm with Configurations 1 and 2. Transport near Dike 14 decreases for both storms with Configuration 3 (Figures C49 to C60). However, this is only indicative of erosion and transport for coarser sediments. This does not include fine sediments or sediments already in suspension

Potential Suspension and Deposition

GTRAN showed areas where erosion and transport can occur for the different configurations (current only). However, the GTRAN results did not adequately address transport issues within the harbor where most of the sediment is fine-grained and much of it is already in suspension when it enters the harbor. Therefore, in addition to GTRAN results, the hydrodynamics from ADCIRC were examined to determine areas of high shear stress and potential suspension and deposition of fine-grained sediment. This section presents results which show potential areas of fine-grained sediment suspension as well as areas of potential deposition. This section also presents results of change in erosional and depositional areas generated by project conditions.

Fine Grained Suspension

Sediment is suspended if the shear stress of the fluid exceeds the critical shear stress for inception of sediment movement. Shear stress was calculated at each GTRAN grid point by the Soulsby (1997) method with currents obtained from the 6-month and 5-year ADCIRC simulations. The maximum shear stress over the time series is shown in Figures C61-C64 for the six month return period event and Figures C65-C68 for the 5-year return period event. Low shear stresses are shown in blue and shear stresses as high as 0.5 Pa is indicated by red. Generally, shear stresses are low in the study area. The highest shear stresses occur off the north side of Dike 14 for both storms and all configurations. However, installation of the proposed CDF restricts flow between the CDF and the breakwater and results in higher shear stresses (0.15-0.2 Pa) in this area for all three configurations for both events.

The locations and frequency of potential fine-grained sediment suspension events were computed for each time step of the 6-month and 5-year ADCIRC results at each GTRAN grid point. A representative critical shear stress for fine-grained suspension of 0.12 Pa was applied. Although a reasonable approximation for the low density fine-grained surface layer, this critical shear stress is just used to represent potential change in scour areas. Actual crtical shear stress is site specific. Critical shear stress measurements for Cleveland Harbor were not part of this scope of work. The number of suspension occurrences (shear stress greater than 0.12 Pa), expressed as a percentage of the total number of time steps in the simulation, is shown in Figure C69-C72 (six month event) and C73-C76 (five-year event). The areas in white indicate that critical shear stress was not exceeded at any time at these locations, and for the assumed conditions, no fine-grained sediment would be suspended. All of the figures show that sediment is suspended ~3% of the time north of Dike 49 for the simulation period (six weeks). The base condition shows sediment suspended at the tip of the breakwater in the area of interest for both the 6-month and 5-year storms (Figures C69 and C73). Inclusion of the CDF indicates that sediment will be suspended and transported between the CDF and the breakwater less than 0.5 percent of the time during the six-week simulation. The areas of suspension are similar for the 6-month and 5-year storms; however, results with the 5-year storm show that suspension occurs farther west of the CDF for Configuration 1 and farther lakeward near the breakwater tip for Configurations 1 and 2.

The suspension frequency between the CDF configurations and base condition was compared for the 6-month (Figures C77 through C79) and 5-year (Figures C80 through C82) storms. Increases in potential suspension duration due to a configuration are shown as positive values and decreases are shown as negative values. It should be noted that negative values don’t necessarily indicate areas of increased deposition, only less suspension. Configurations 1 and 2 show an increase up to 0.15 percent in suspension events between the CDF and the breakwater, and a decrease up to 0.15 percent at the breakwater tip for the 6-month storm (Figures C77 and C78). Suspension duration also increases between the CDF and breakwater with Configuration 3; however, the increase is less (~0.05 percent) (Figure C79). Similar differences are observed with the 5-year storm, but there is no difference in shear stress at the breakwater tip for Configurations 1 and 2 (Figures C80 and C81). Configuration 3 includes the extension of the breakwater and, as a result, shear stress decreases at the location of existing breakwater tip (Figure C82). However, no change in shear stress occurs at the proposed new tip from base conditions. Additionally, shear stress decreases north of Dike 14 with Configuration 3 with both the 6-month and 5-year storms.

The figures indicate that the hydrodynamics of the 6-month and 5-year storms will not significantly suspend additional sediment from the bottom. The areas where sediment suspension time periods increase will be between the CDF and breakwater, but these increases are 0.15 percent or less.

Deposition

The above analysis indicates areas where fine-grained sediment erosion changes may occur. However, changes in deposition patterns must also be assessed for each design scenario. A parameter was computed based on sediment size and flow magnitude to determine locations of potential sedimentation. Settling of suspended sediments can occur if the shear velocity, u_*, of the flow approaches the fall speed of the suspended sediment, w_s assuming the particles do not flocculate. Therefore, if the ratio of u_* to w_s is less than unity, settling of suspended sediment should occur. The shear velocity is defined as:

$$u_* = \sqrt{\frac{\tau}{\rho}} \tag{6}$$

in which τ is shear stress of the flow and ρ is density of the fluid. Fall velocity was calculated by the optimization of Soulsby (1997):

$$w_s = \frac{\nu}{d_{50}} \sqrt{10.36^2 + 1.049 D_*^3} - 10.36 \tag{7}$$

where υ is kinematic viscosity, d_{50} is the sediment diameter, and D_* is the dimensionless particle size parameter (Equation 5).

Suspended solids concentrations are spatially and temporally varying over the domain. Since there is no sediment transport model available for Cleveland Harbor, concentrations and settling rates cannot be quantified. However, the detailed hydrodynamic model permits us to quantify times were deposition will likely occur at each grid cell in the domain. For this assessment, it is assumed that fine-grained sediment is always available in the water column for deposition. The percentage of deposition occurrences (as estimated using equations 6 and 7) was computed for each time step in the 6-month and 5-year storms over the GTRAN grid (Figures C83 through C90). The present (base) condition shows a high percentage of time for potential deposition midway between the East 55th State Marina and the breakwater. For all three configurations, deposition decreased between the CDF and breakwater due to higher shear stress magnitudes. The presence of the CDF increases potential deposition near the shoreline within and east of the breakwater. Additionally, the figures indicate deposition occurs 20-40 percent of the time outside the breakwater. It should be noted again that outside the breakwater, waves would have an impact on deposition potential. Inclusion of waves would keep sediment in suspension and show less deposition, especially outside of the breakwater.

Figures C91 through C96 show the percent change in time periods of potential deposition between the configuration plans and the base condition. In all configurations and with both storms less deposition occurred between the CDF and the breakwater by approximately 40 percent. Deposition increased along the sides of the CDF; predominately on the northeast side. Increased duration of deposition for Configuration 1 was approximately 30 to 35 percent along the northeast side and 25 to 30 percent along the southwest side for the 6-month and 5-year storms. Deposition time duration increased approximately 35 percent northeast of the Configuration 2 CDF and 15 to 20 percent on the southwest side for both storms. Deposition increase along the Configuration 3 CDF was typically 40 percent, northeast side, and 15 percent, southwest side.

Conclusions

The GTRAN model and shear stress analysis were applied to assess changes in erosion and deposition induced by CDF construction. Two major events were simulated. Analysis indicates that the area around the proposed CDF remains predominately non-erosional. Sediment suspension is not altered significantly by the CDF. However, time periods of potential deposition were altered significantly with the proposed CDF. Areas between the CDF and breakwater will experience less depositional conditions while areas to the east and west of the proposed CDF would experience more time periods where deposition can occur.

References

Soulsby, R.L., 1997. Dynamics of Marine Sands. Thomas Telford Publications, London, UK.

van Rijn, L. C. 1984. Sediment transport: Part I: Bed load transport; Part II: Suspended load transport; Part III: Bed forms and alluvial roughness. Journal of Hydraulic Engineering 110(10):1431–1456; 110(11):1613–1641; 110(12):1733–1754.

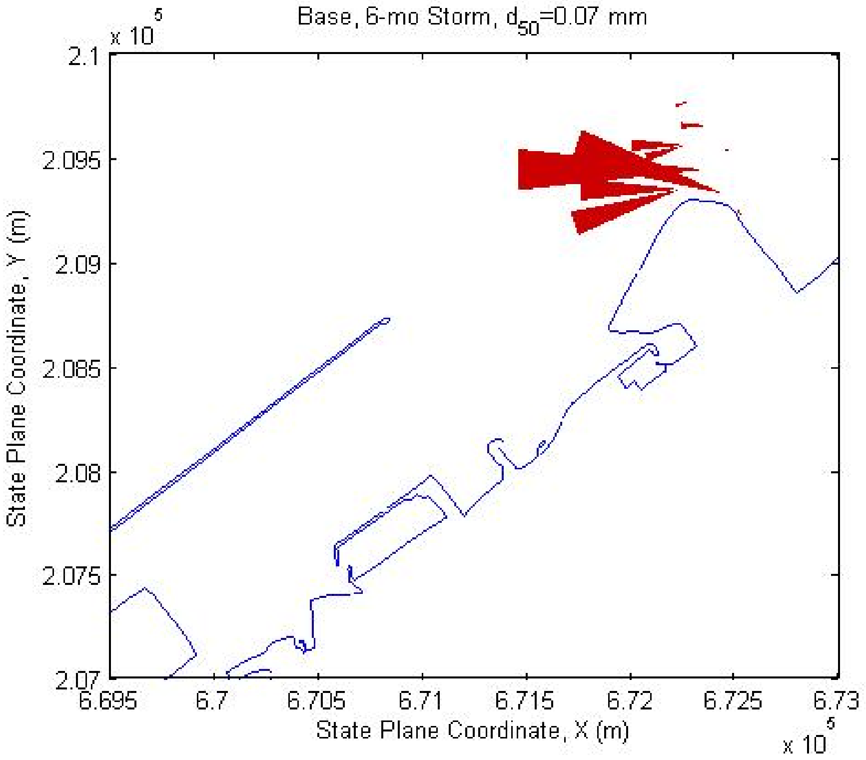


Figure C1. Sediment transport rose plots for Base conditions, 6-mo storm, d_{50}=0.07 mm

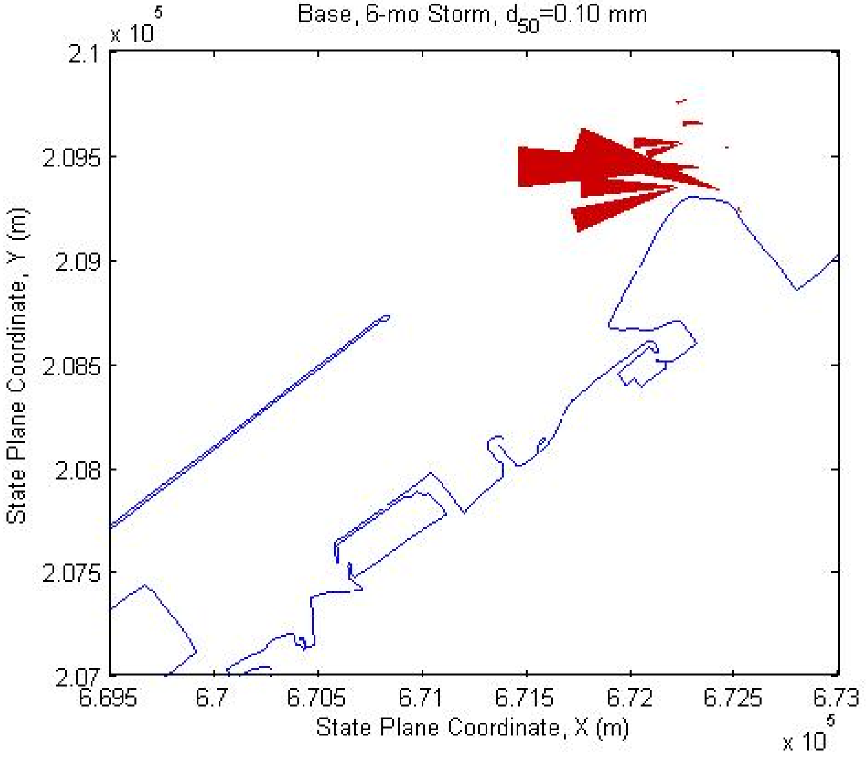


Figure C2. Sediment transport rose plots for Base conditions, 6-mo storm, d_{50}=0.10 mm

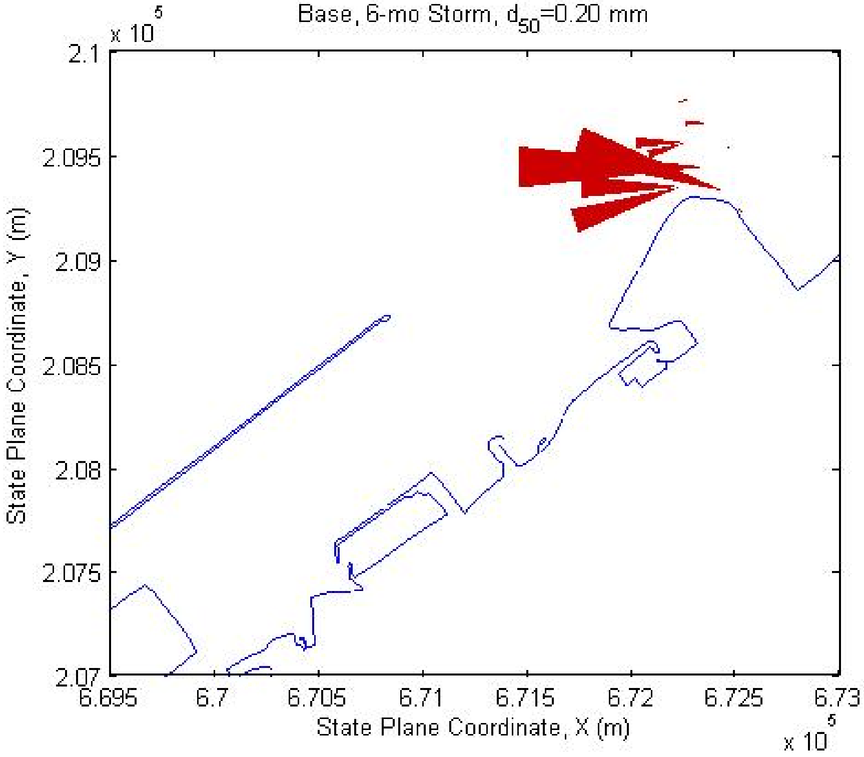


Figure C3. Sediment transport rose plots for Base conditions, 6-mo storm, d_{50}=0.20 mm

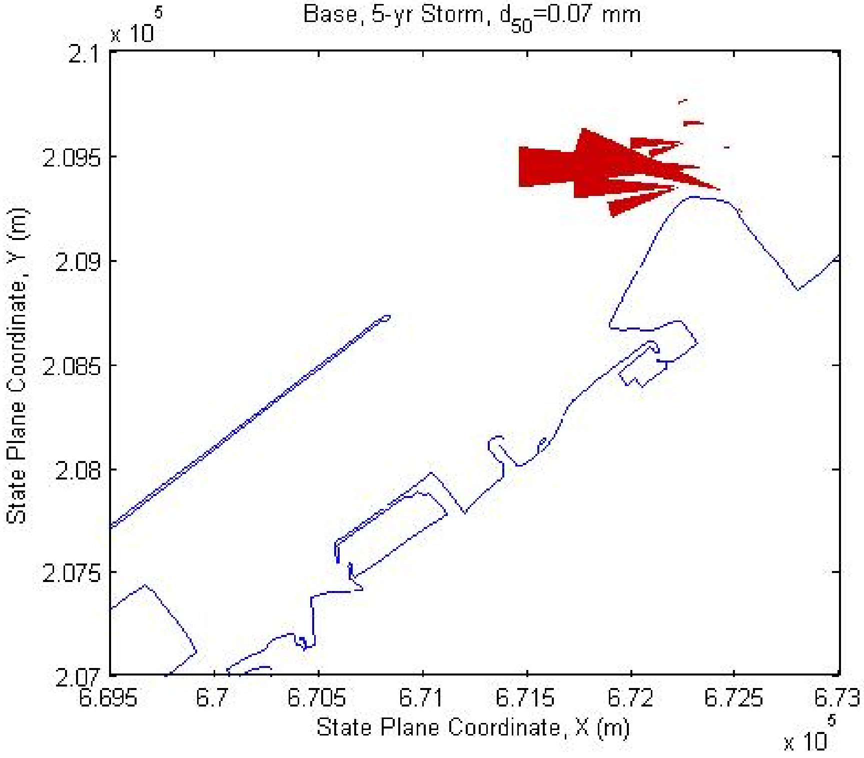


Figure C4. Sediment transport rose plots for Base conditions, 5-year storm, d_{50}=0.07 mm

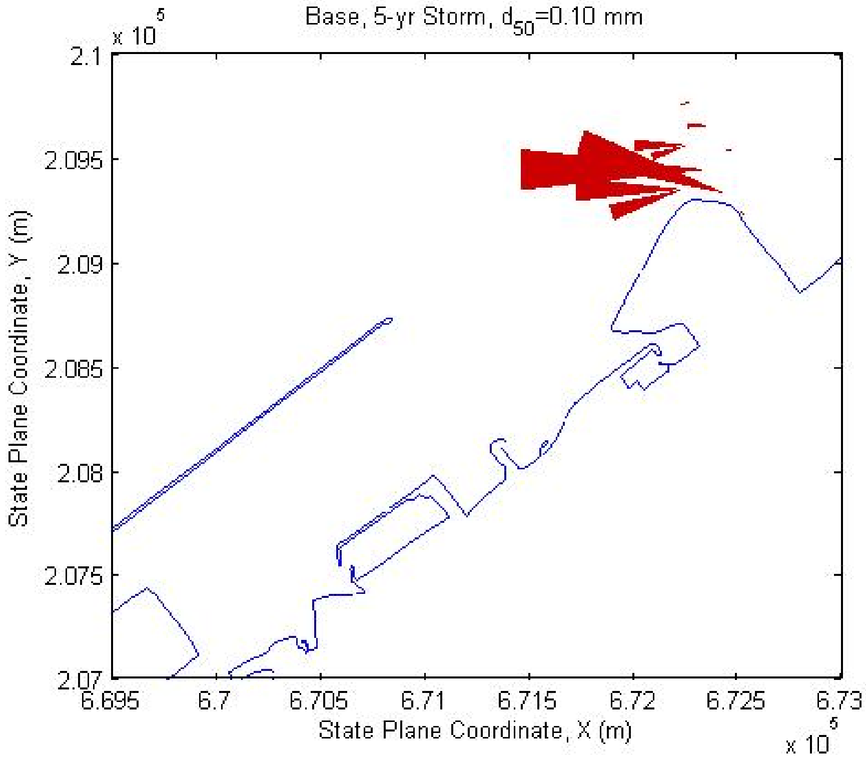


Figure C5. Sediment transport rose plots for Base conditions, 5-year storm, d_{50}=0.10 mm

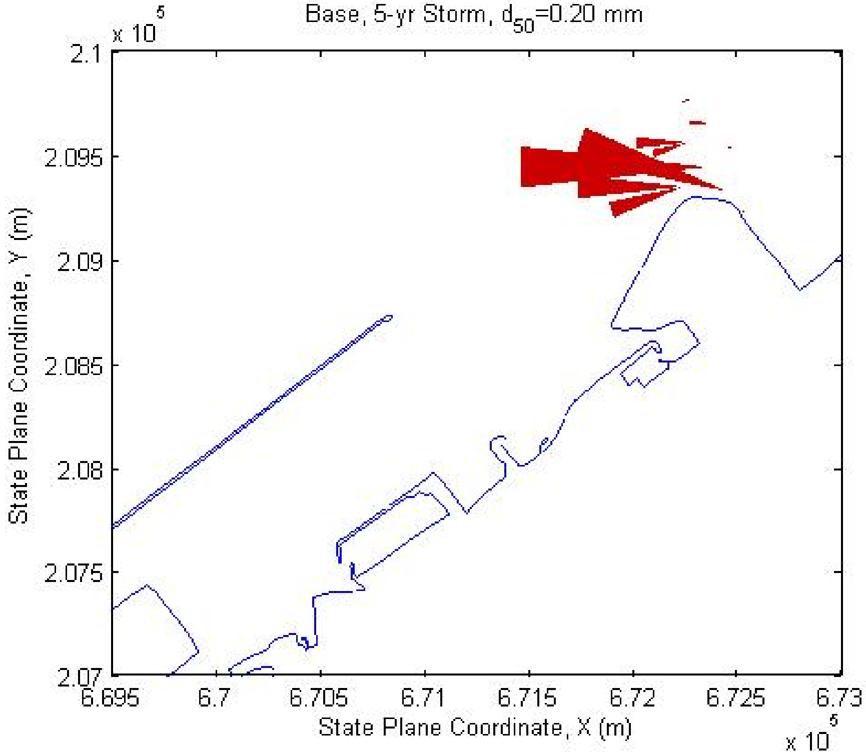


Figure C6. Sediment transport rose plots for Base conditions, 5-year storm, d_{50}=0.20 mm

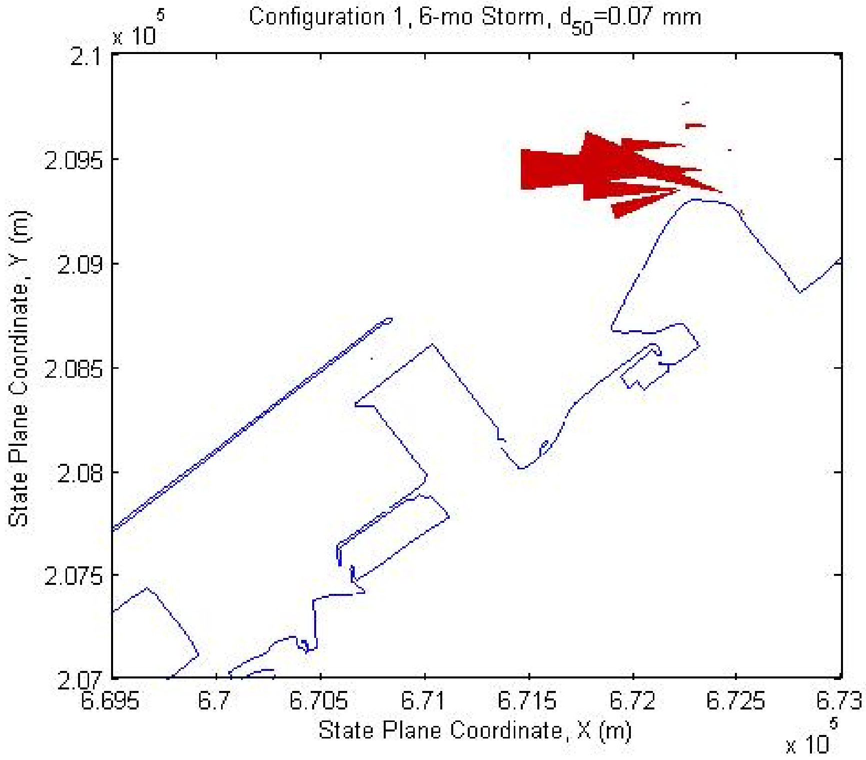


Figure C7. Sediment transport rose plots for Configuration 1, 6-mo storm, d_{50}=0.07 mm

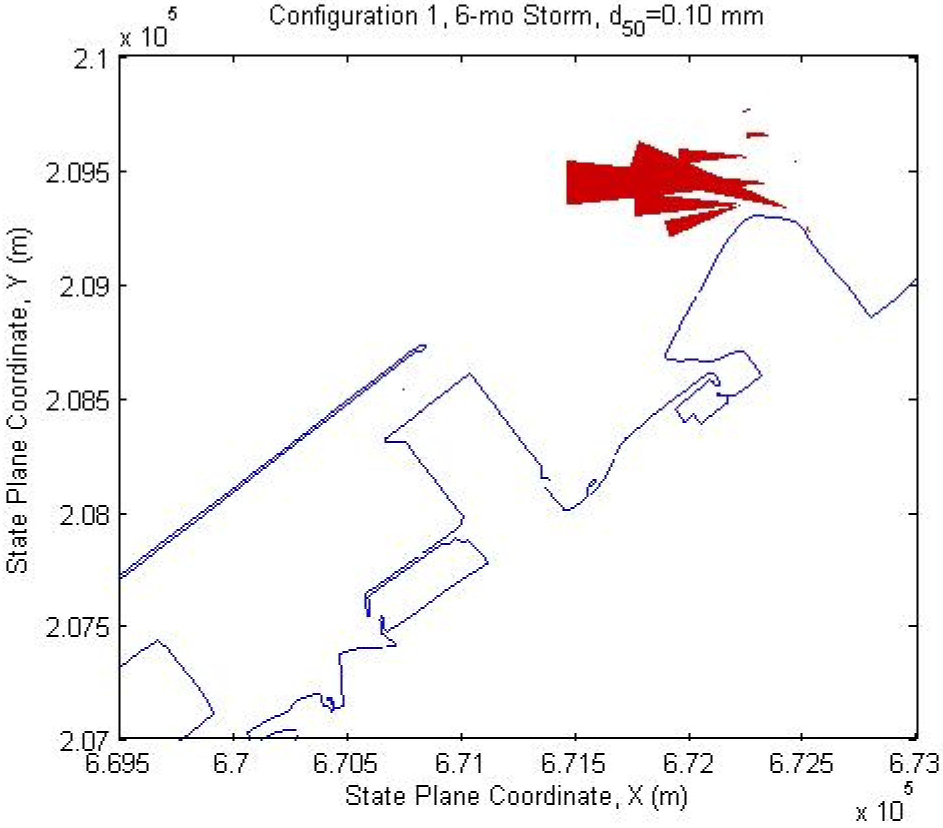


Figure C8. Sediment transport rose plots for Configuration 1, 6-mo storm, d_{50}=0.10 mm

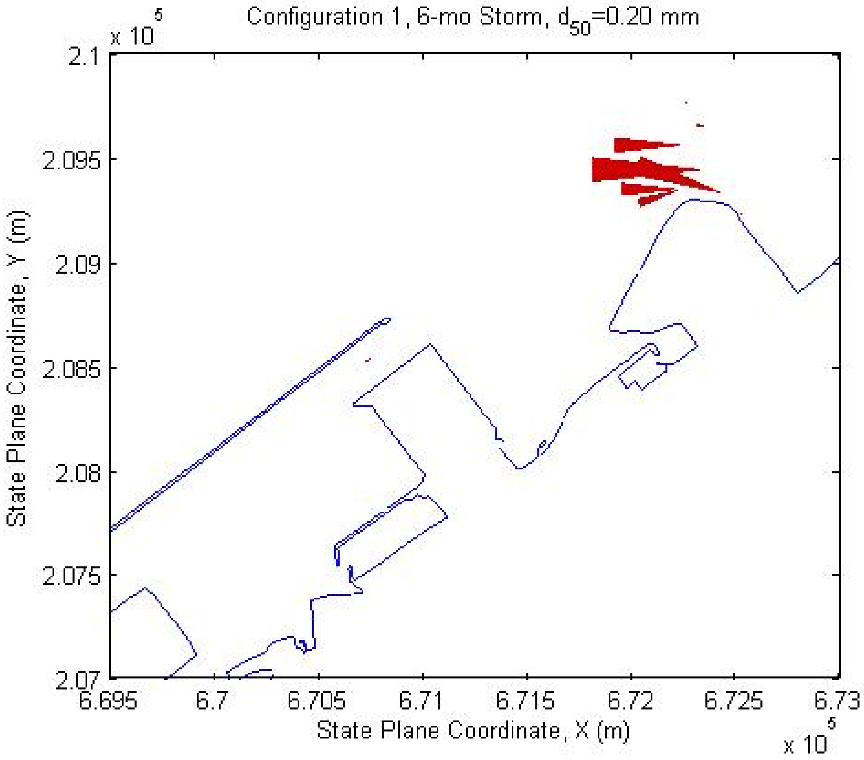


Figure C9. Sediment transport rose plots for Configuration 1, 6-mo storm, d_{50}=0.20 mm

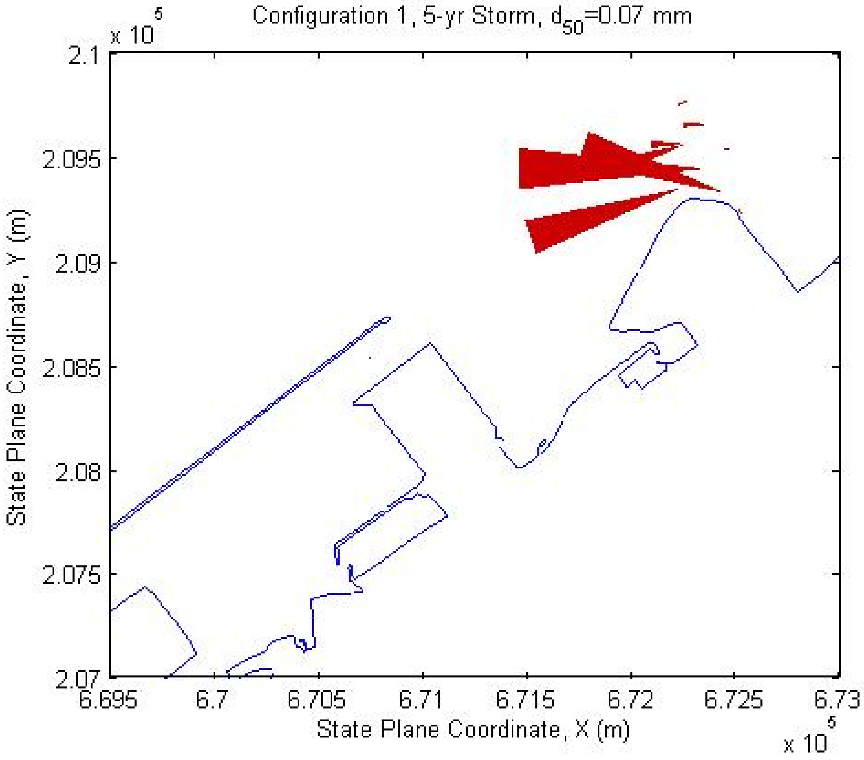


Figure C10. Sediment transport rose plots for Configuration 1, 5-year storm, d_{50}=0.07 mm

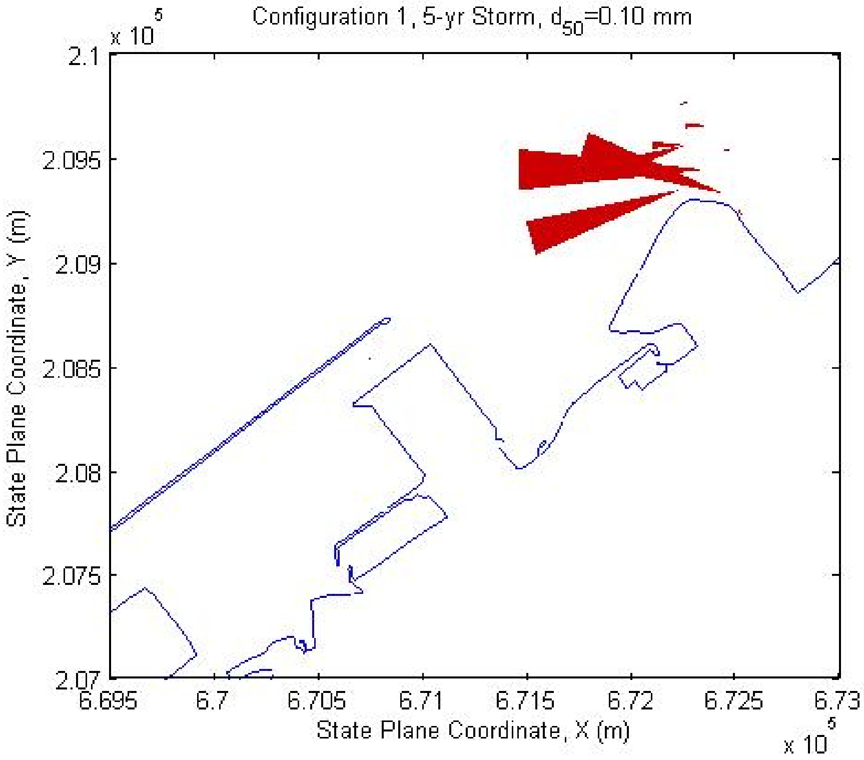


Figure C11. Sediment transport rose plots for Configuration 1, 5-year storm, d_{50}=0.10 mm

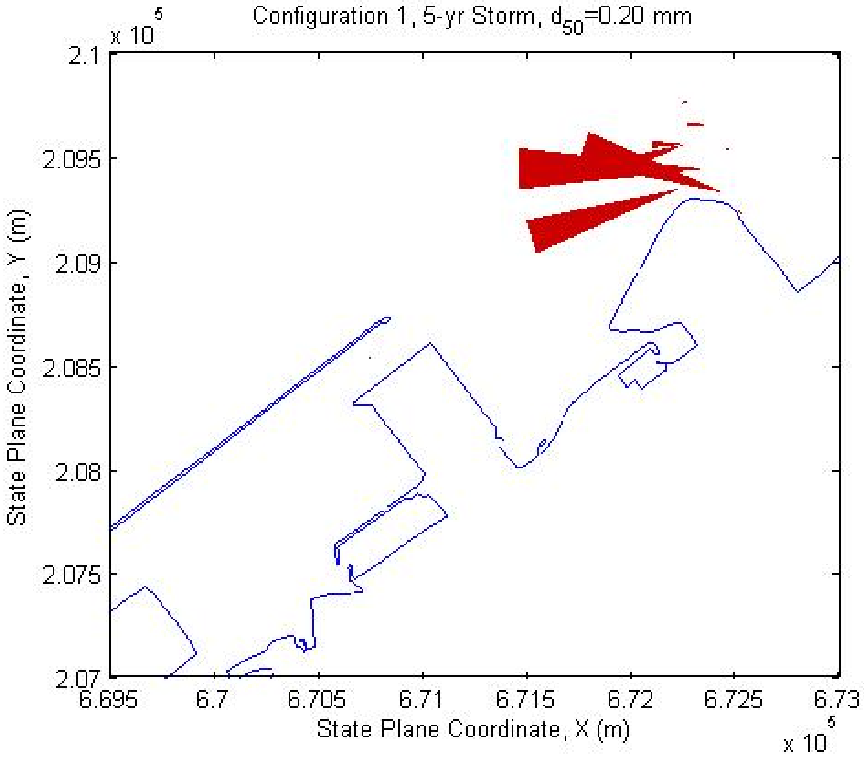


Figure C12. Sediment transport rose plots for Configuration 1, 5-year storm, d_{50}=0.20 mm

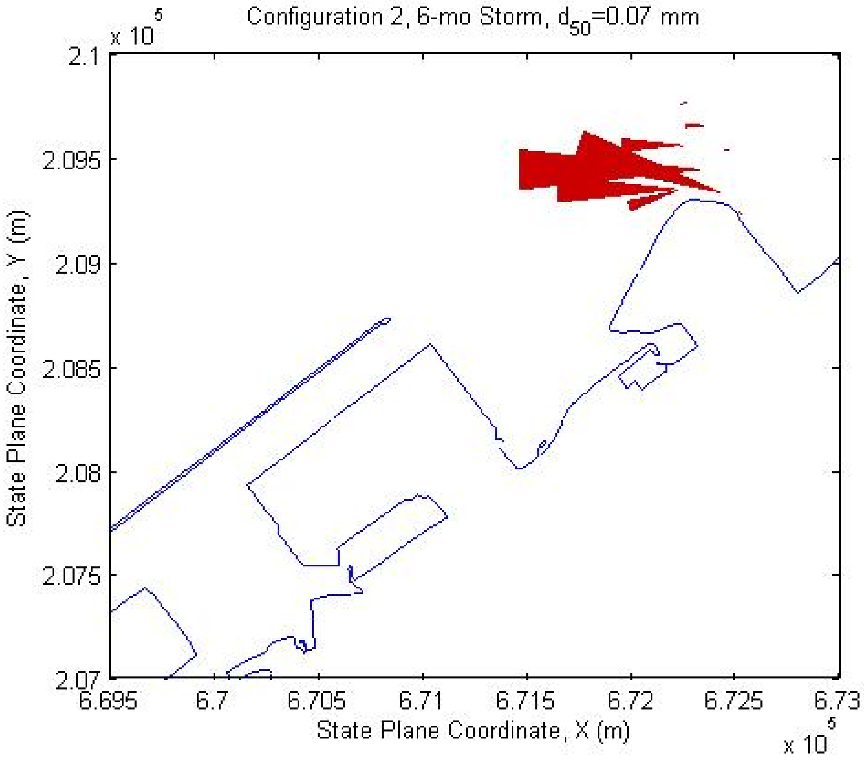


Figure C13. Sediment transport rose plots for Configuration 2, 6-mo storm, d_{50}=0.07 mm

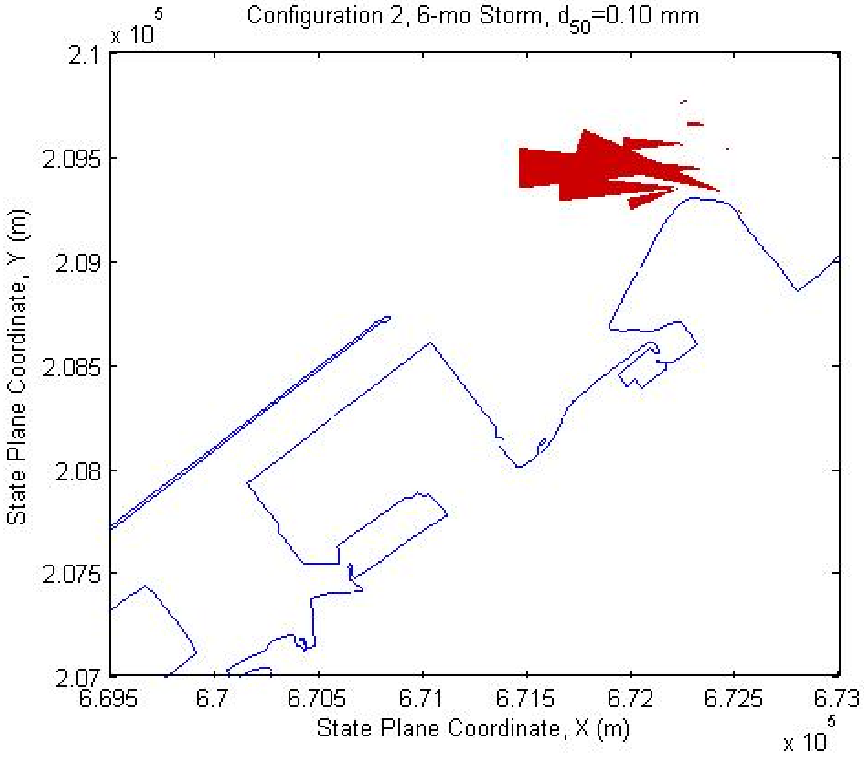


Figure C14. Sediment transport rose plots for Configuration 2, 6-mo storm, d_{50}=0.10 mm

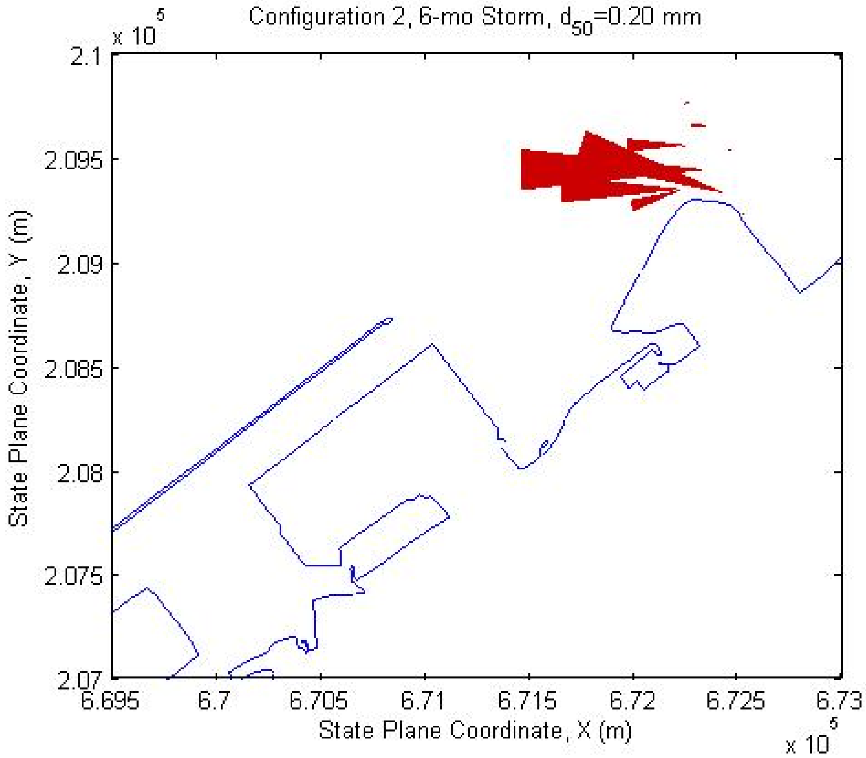


Figure C15. Sediment transport rose plots for Configuration 2, 6-mo storm, d_{50}=0.20 mm

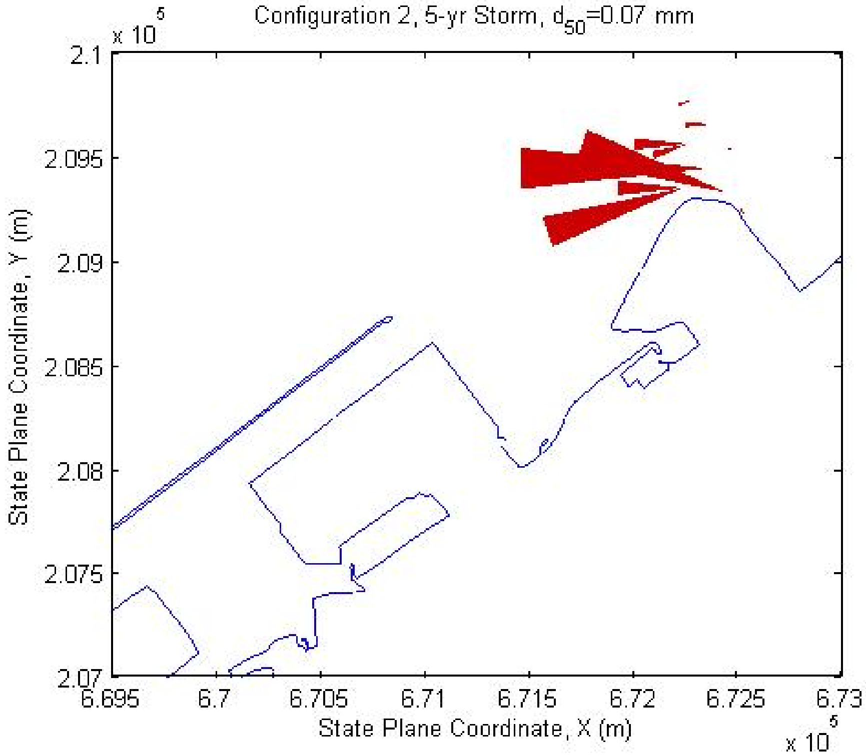


Figure C16. Sediment transport rose plots for Configuration 2, 5-year storm, d_{50}=0.07 mm

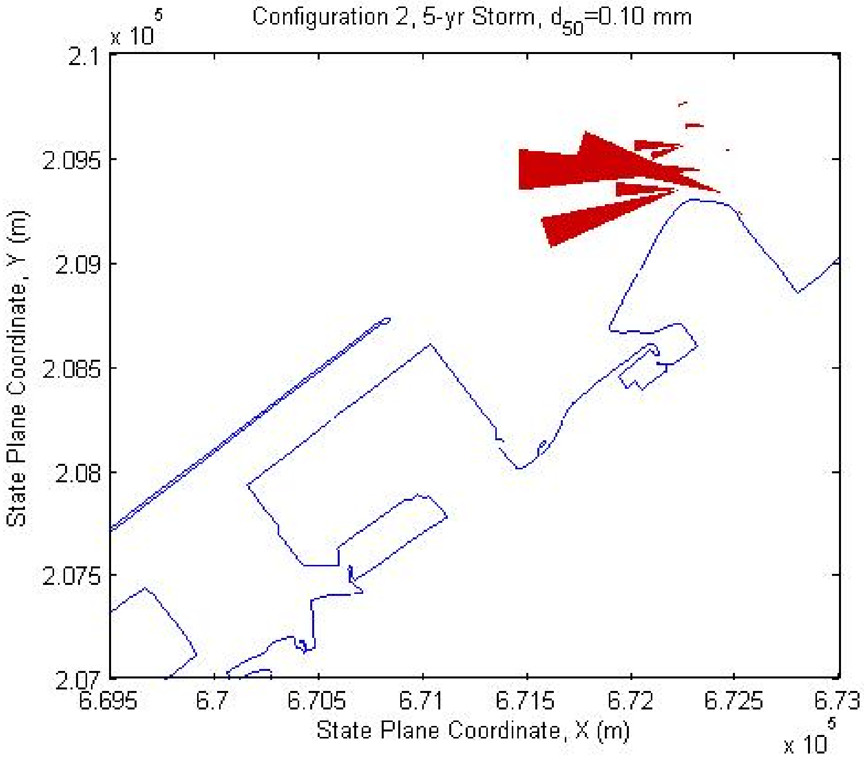


Figure C17. Sediment transport rose plots for Configuration 2, 5-year storm, d_{50}=0.10 mm

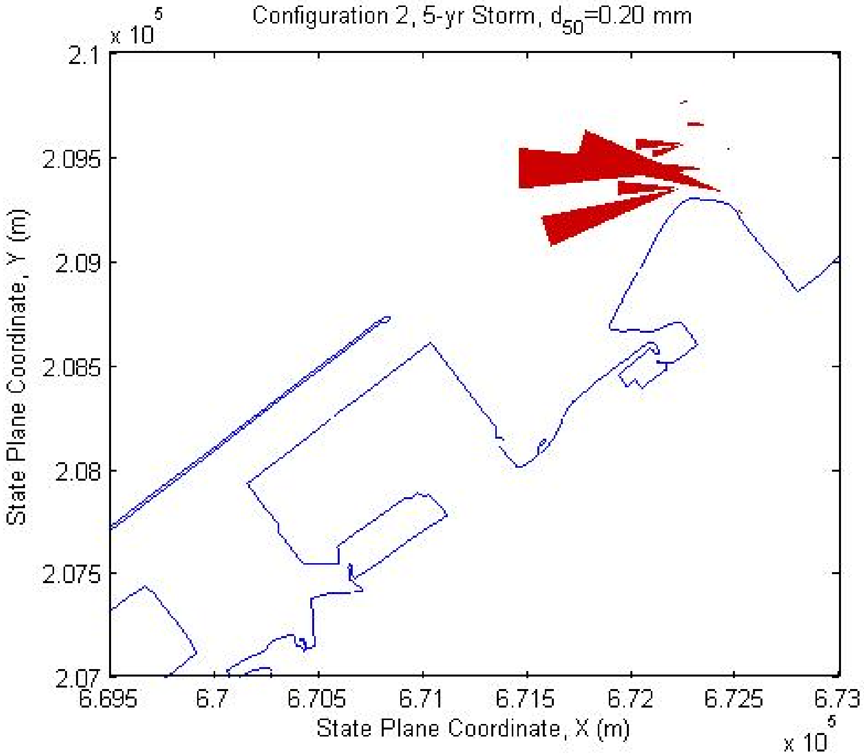


Figure C18. Sediment transport rose plots for Configuration 2, 5-year storm, d_{50}=0.20 mm

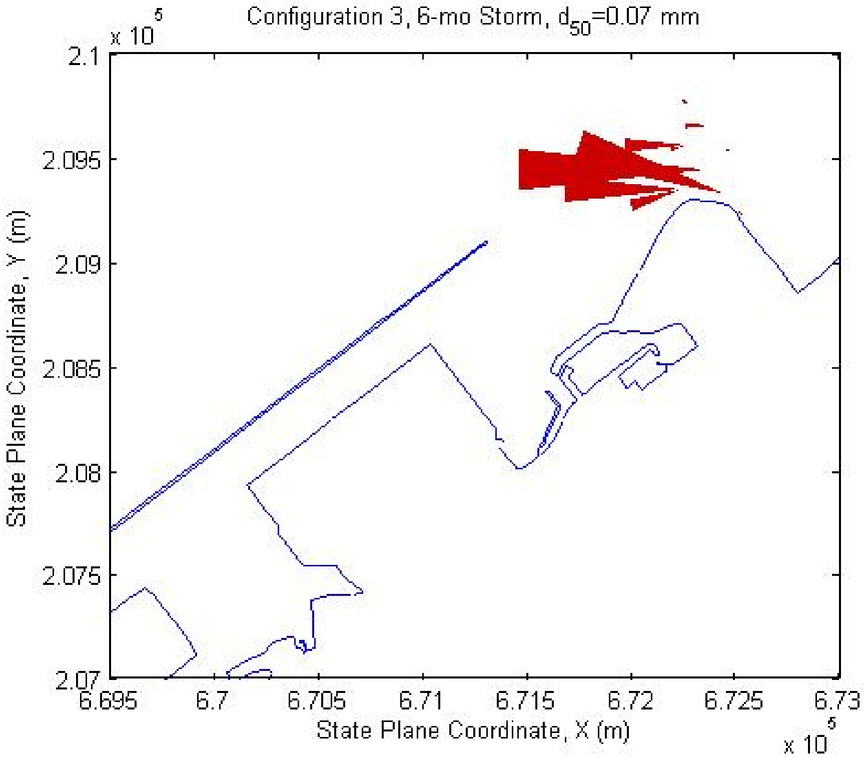


Figure C19. Sediment transport rose plots for Configuration 3, 6-mo storm, d_{50}=0.07 mm

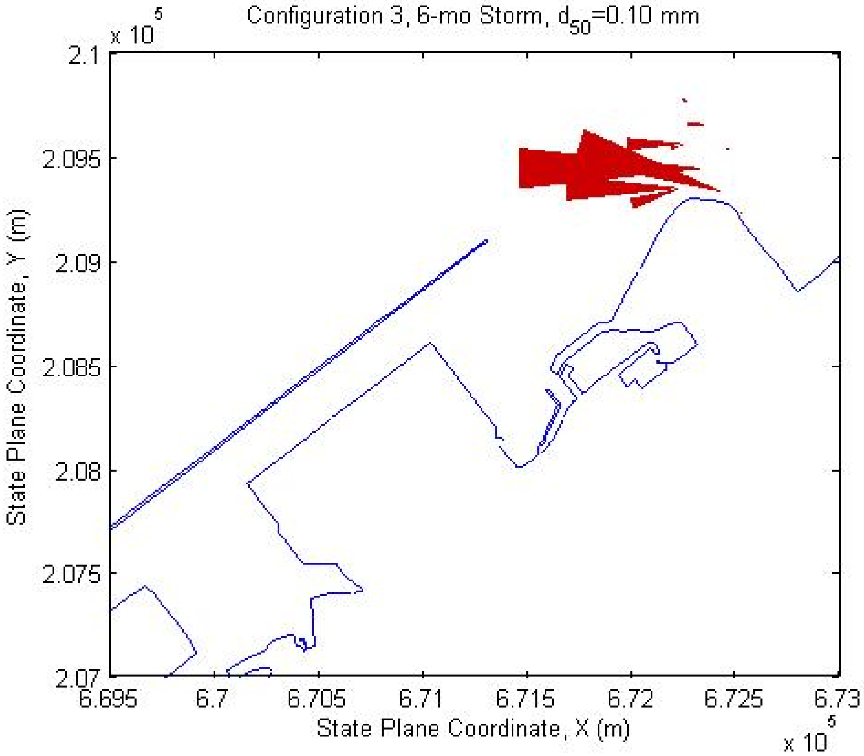


Figure C20. Sediment transport rose plots for Configuration 3, 6-mo storm, d_{50}=0.10 mm

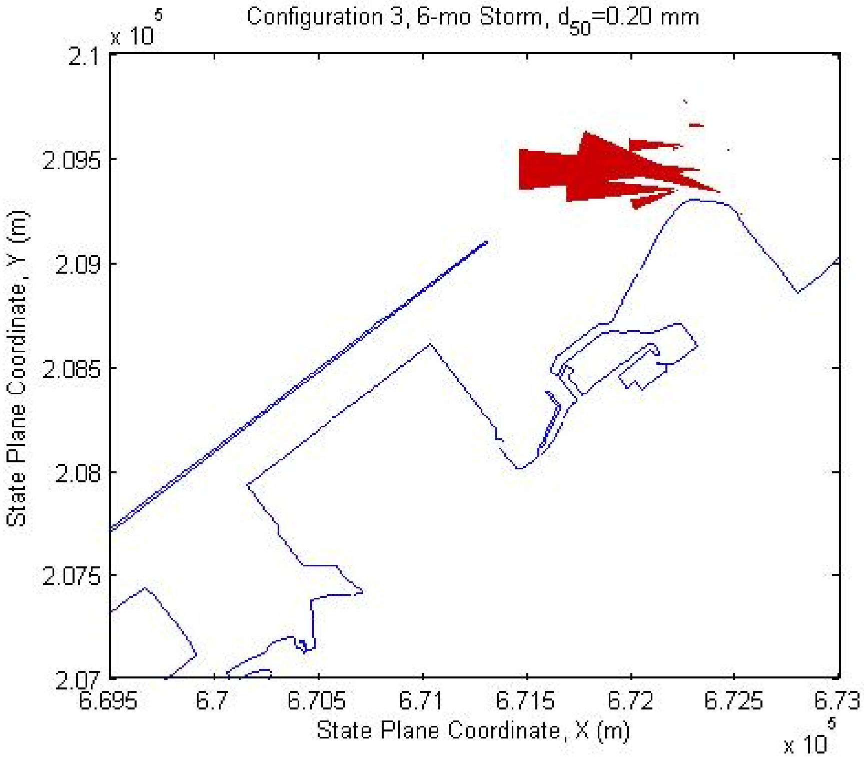


Figure C21. Sediment transport rose plots for Configuration 3, 6-mo storm, d_{50}=0.20 mm

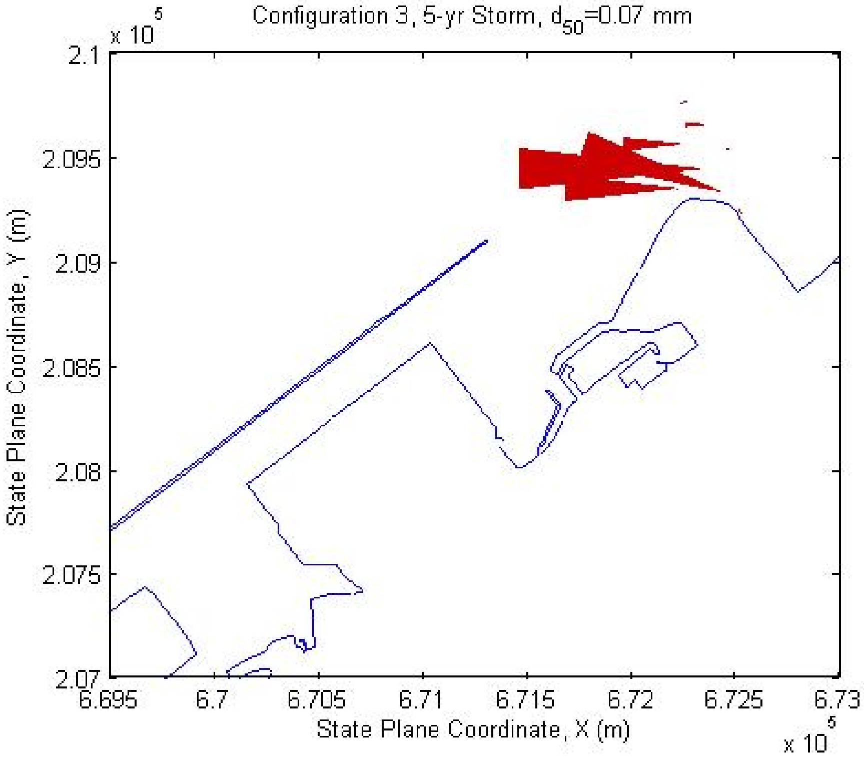


Figure C22. Sediment transport rose plots for Configuration 3, 5-year storm, d_{50}=0.07 mm

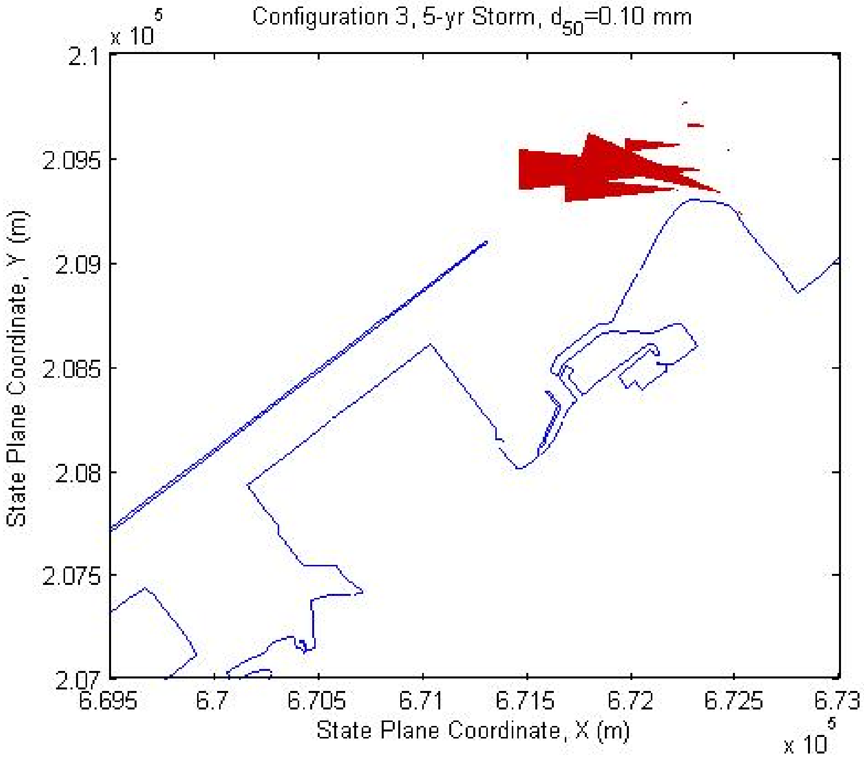


Figure C23. Sediment transport rose plots for Configuration 3, 5-year storm, d_{50}=0.10 mm

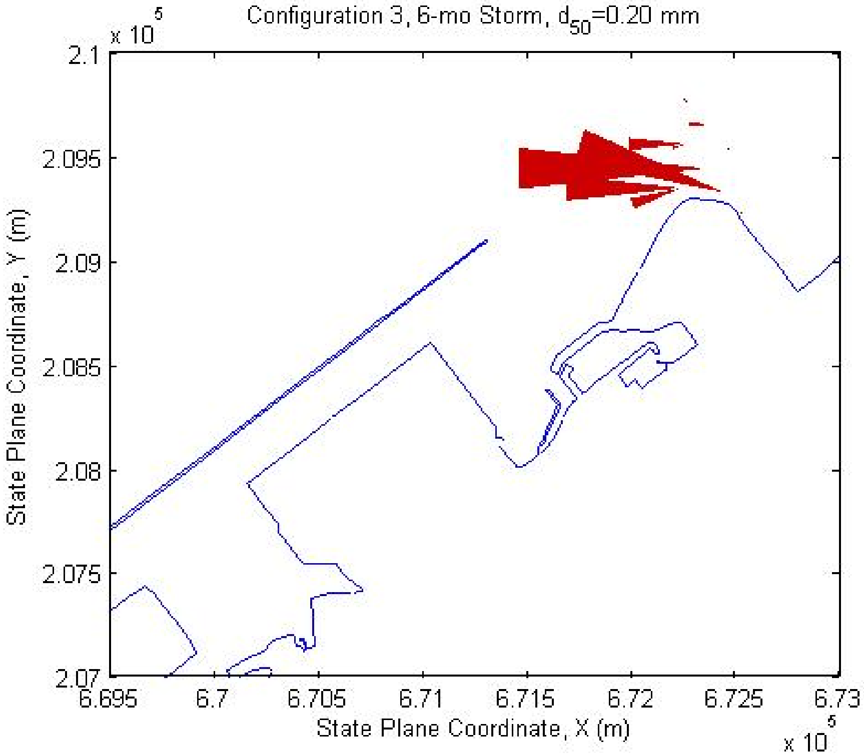


Figure C24. Sediment transport rose plots for Configuration 3, 5-year storm, d_{50}=0.20 mm

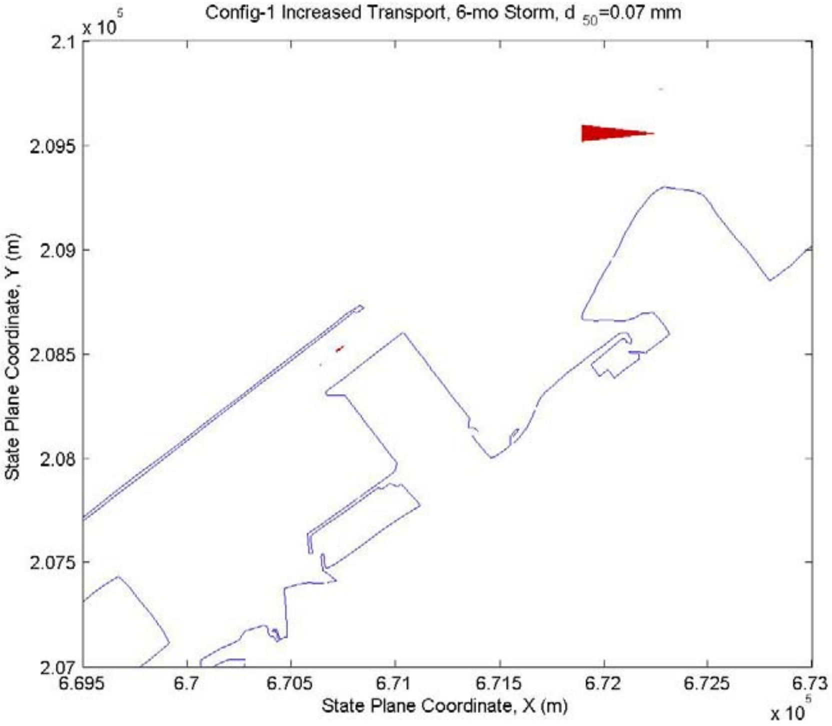


Figure C25. Configuration 1 increased transport, 6-mo storm, d_{50}=0.07 mm

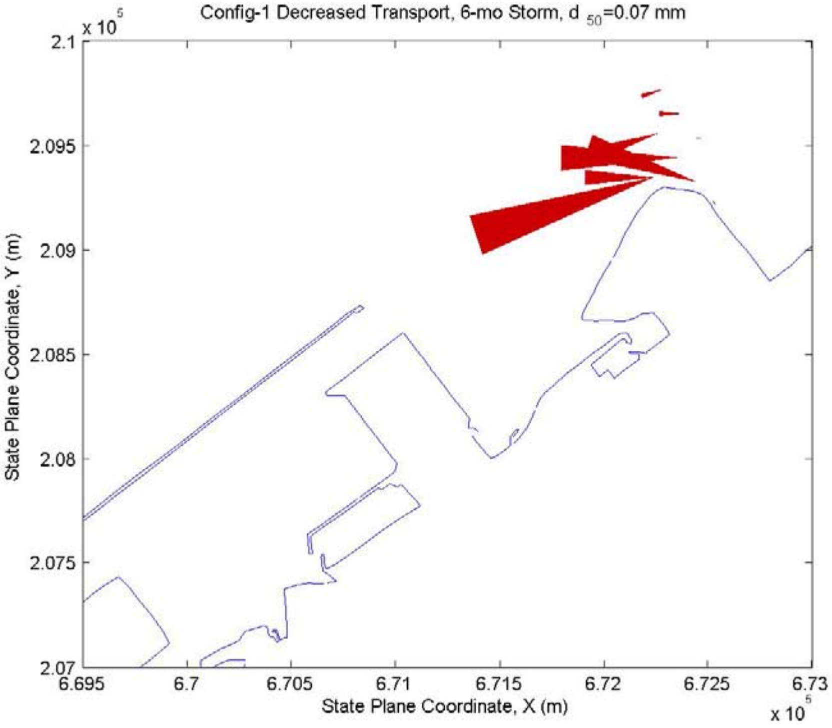


Figure C26. Configuration 1 decreased transport, 6-mo storm, d_{50}=0.07 mm

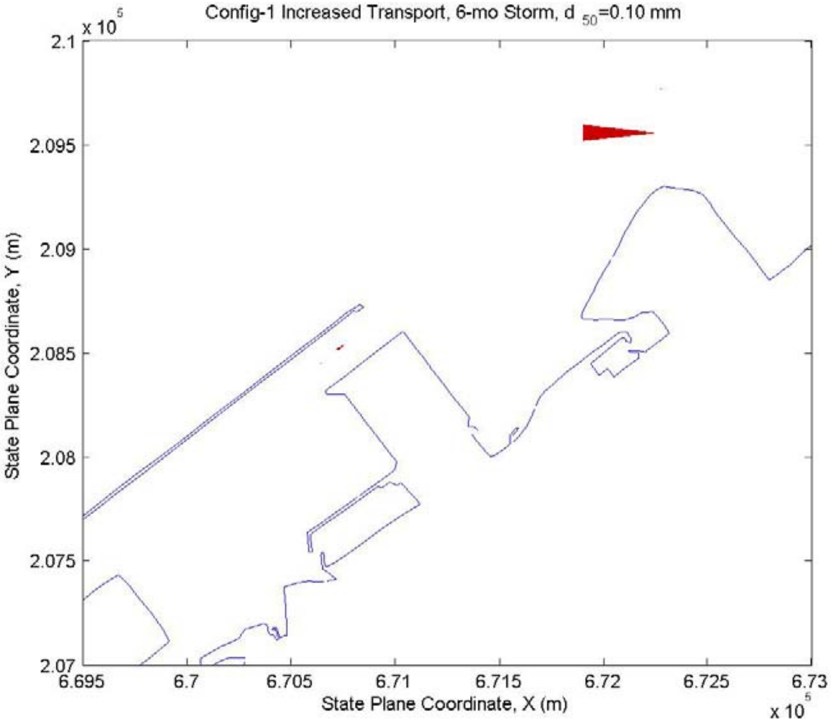


Figure C27. Configuration 1 increased transport, 6-mo storm, d_{50}=0.10 mm

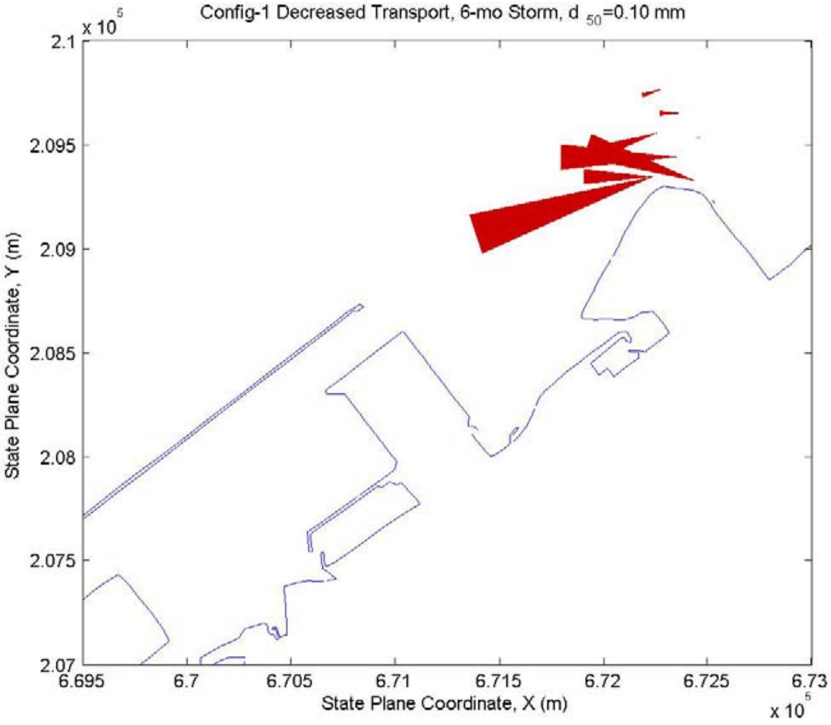


Figure C28. Configuration 1 decreased transport, 6-mo storm, d_{50}=0.10 mm

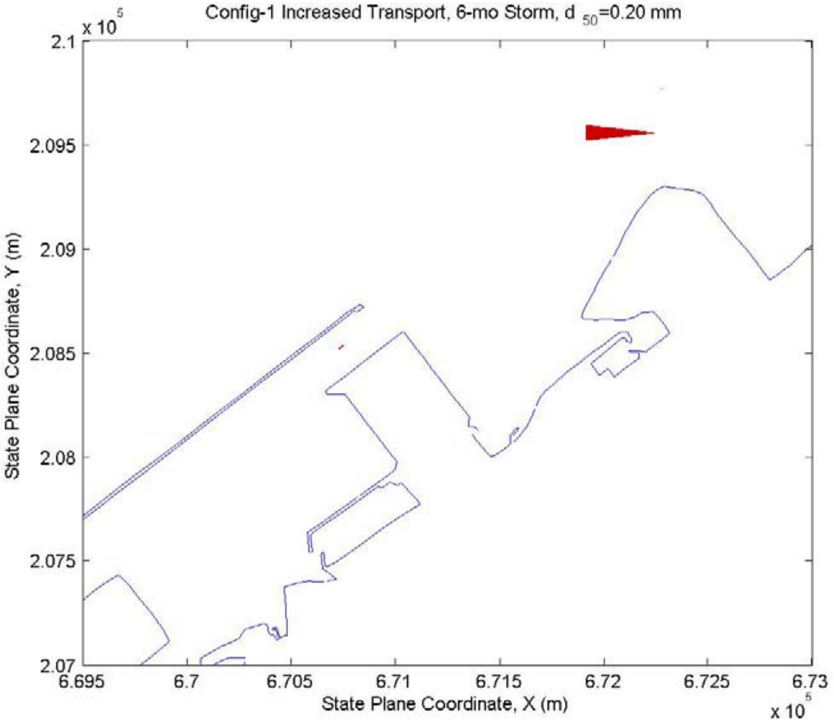


Figure C29. Configuration 1 increased transport, 6-mo storm, d_{50}=0.20 mm

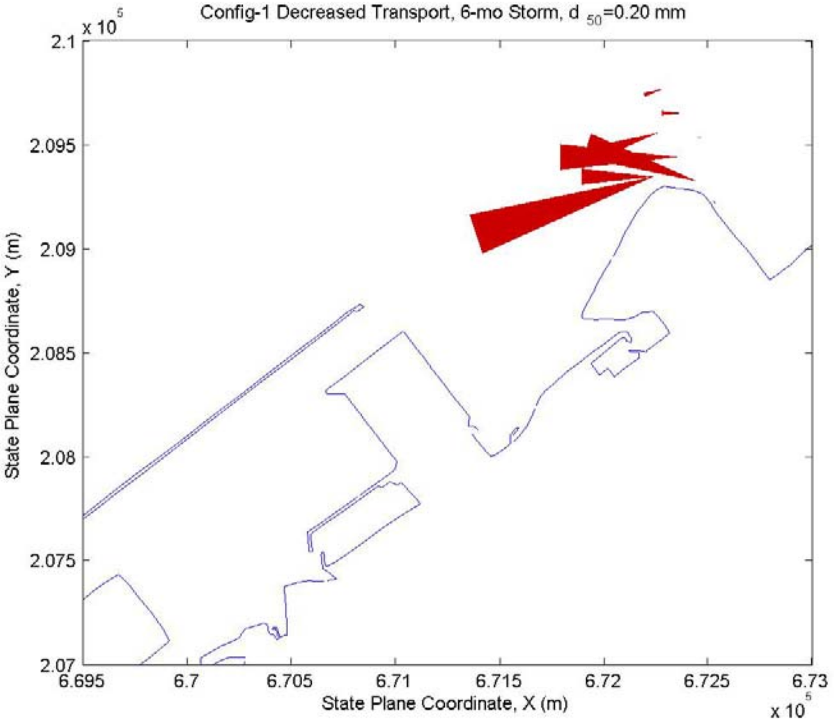


Figure C30. Configuration 1 decreased transport, 6-mo storm, d_{50}=0.20 mm

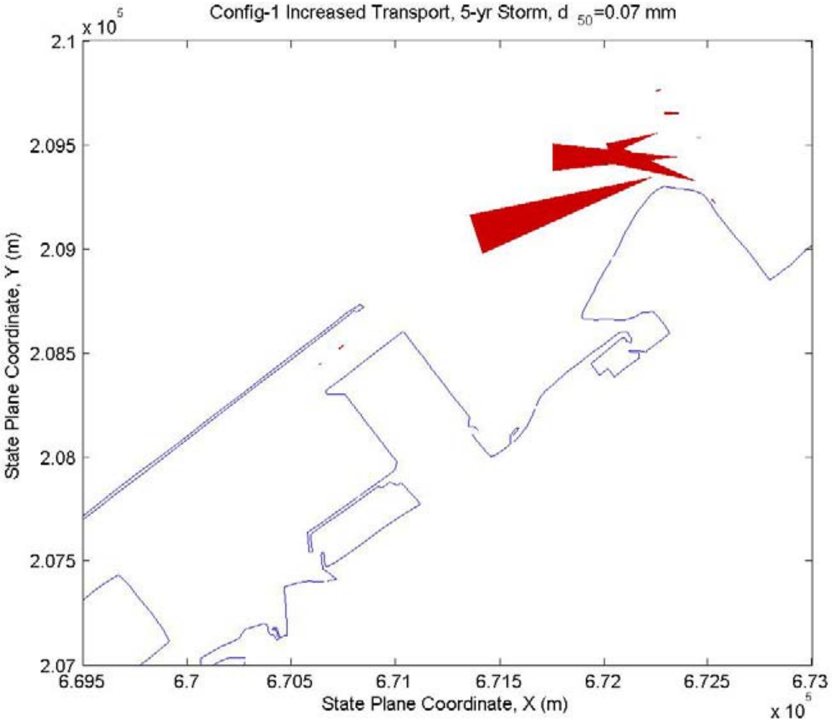


Figure C31. Configuration 1 increased transport, 5-year storm, d_{50}=0.07 mm

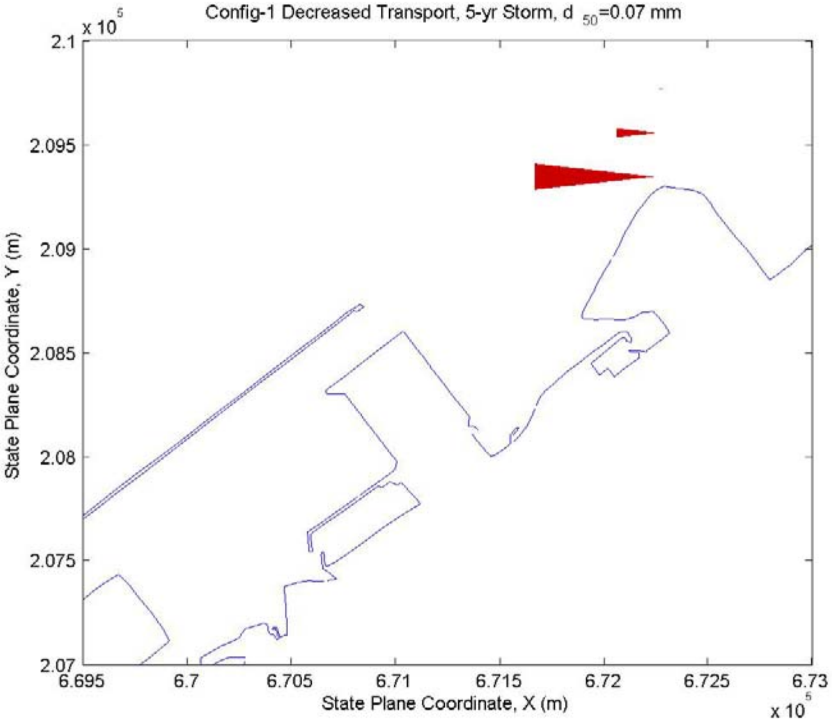


Figure C32. Configuration 1 decreased transport, 5-year storm, d_{50}=0.07 mm

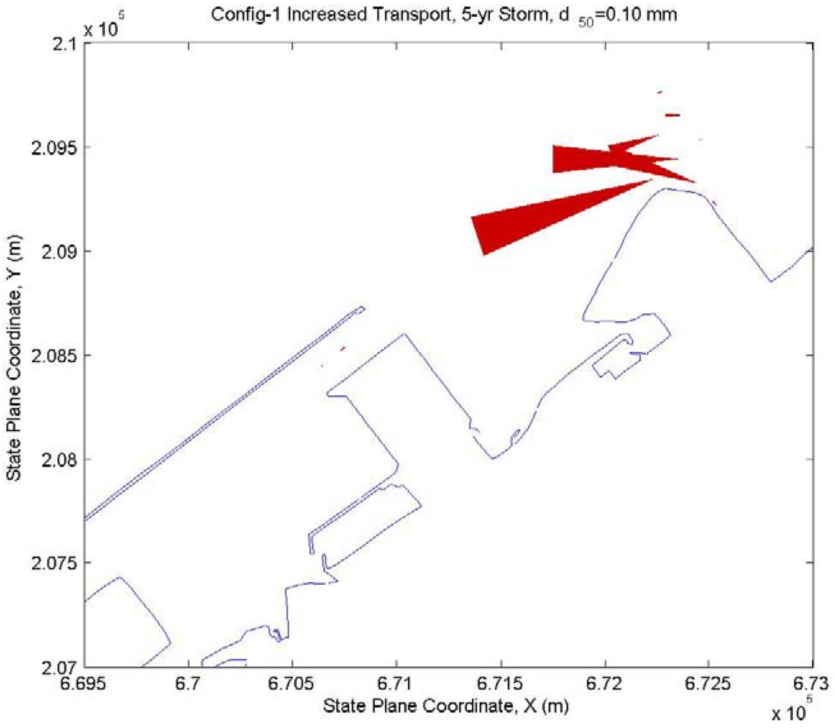


Figure C33. Configuration 1 increased transport, 5-year storm, d_{50}=0.10 mm

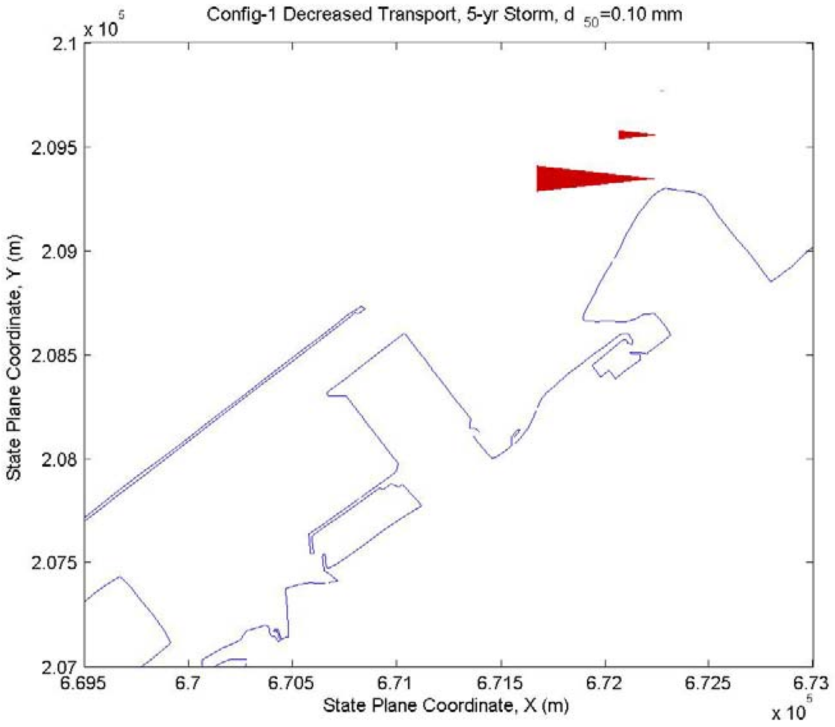


Figure C34. Configuration 1 decreased transport, 5-year storm, d_{50}=0.10 mm

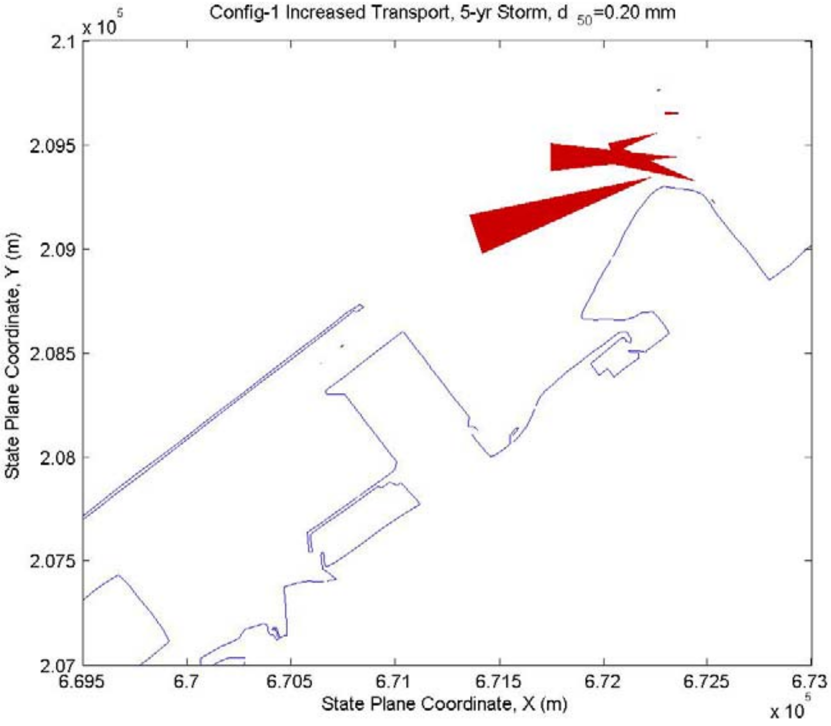


Figure C35. Configuration 1 increased transport, 5-year storm, d_{50}=0.20 mm

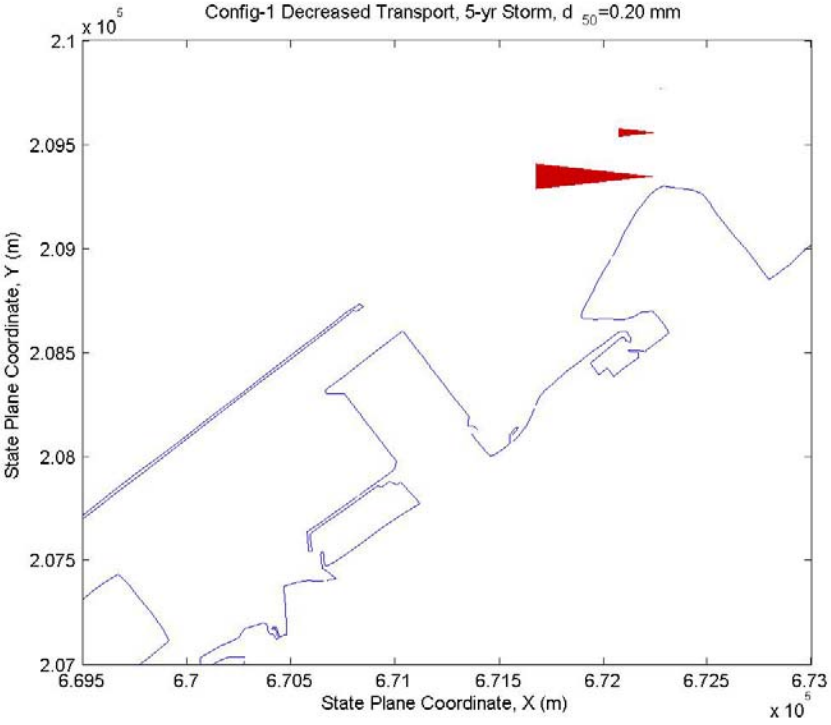


Figure C36. Configuration 1 decreased transport, 5-year storm, d_{50}=0.20 mm

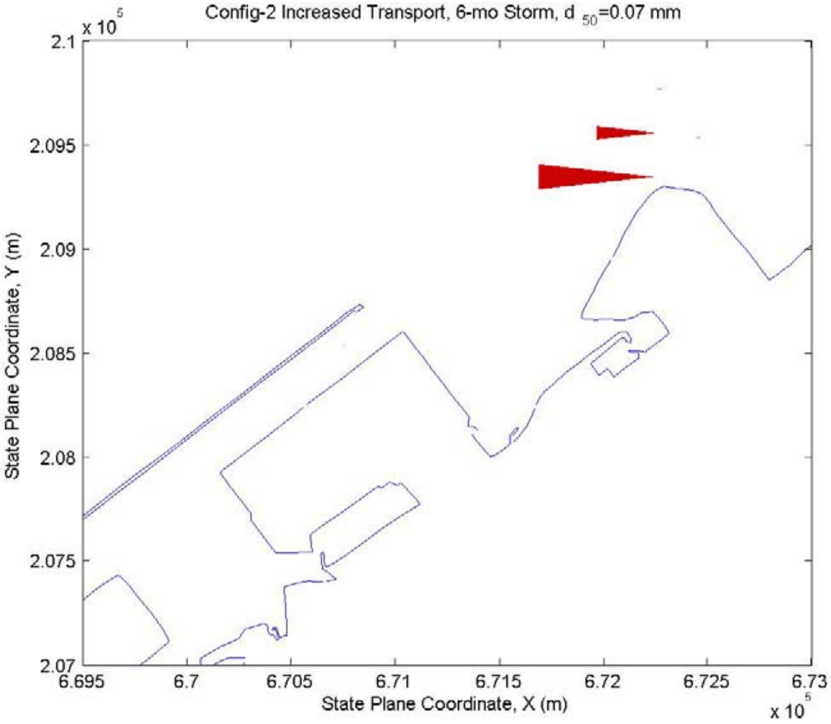


Figure C37. Configuration 2 increased transport, 6-mo storm, d_{50}=0.07 mm

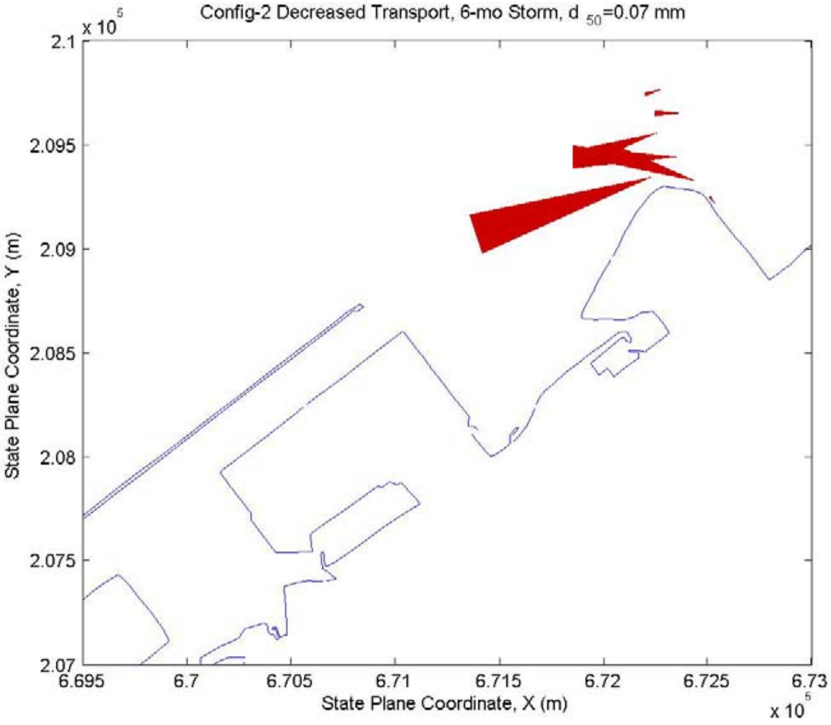


Figure C38. Configuration 2 decreased transport, 6-mo storm, d_{50}=0.07 mm

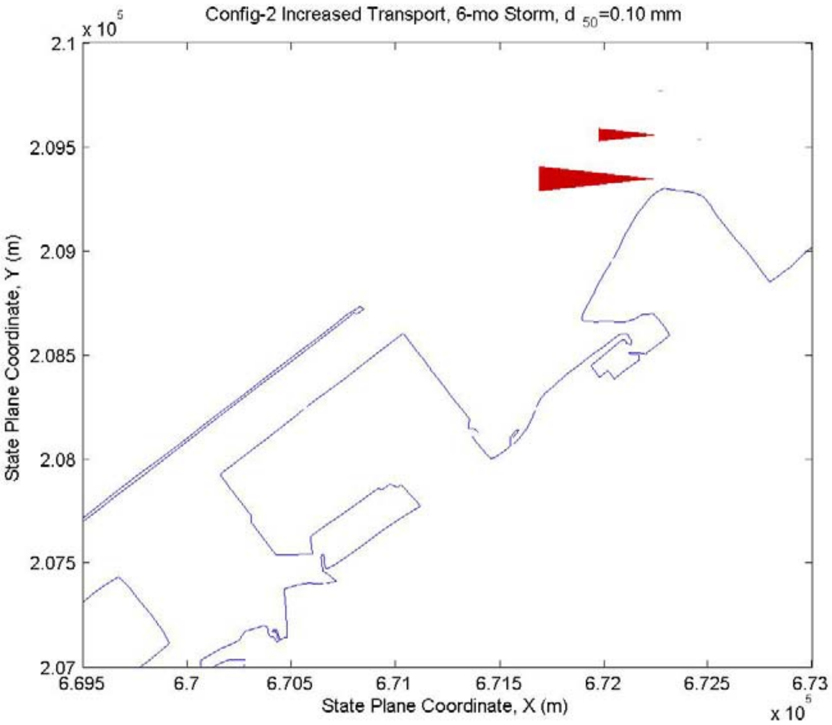


Figure C39. Configuration 2 increased transport, 6-mo storm, d_{50}=0.10 mm

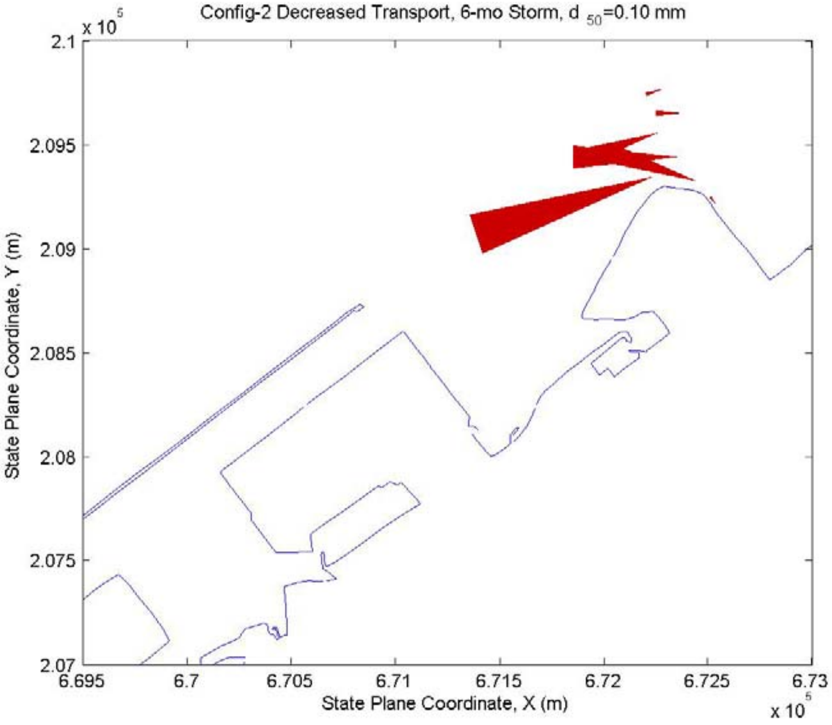


Figure C40. Configuration 2 decreased transport, 6-mo storm, d_{50}=0.10 mm

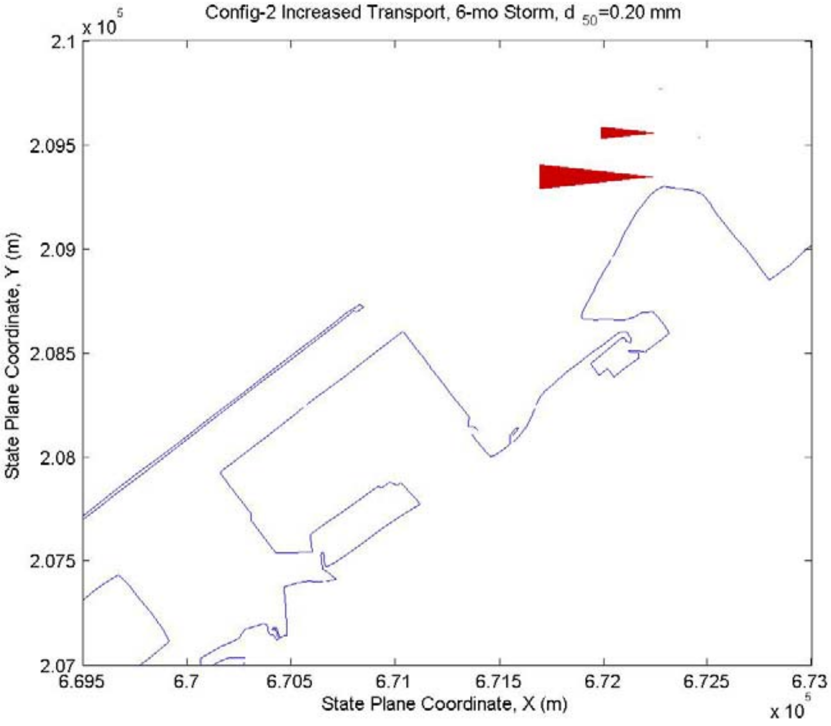


Figure C41. Configuration 2 increased transport, 6-mo storm, d_{50}=0.20 mm

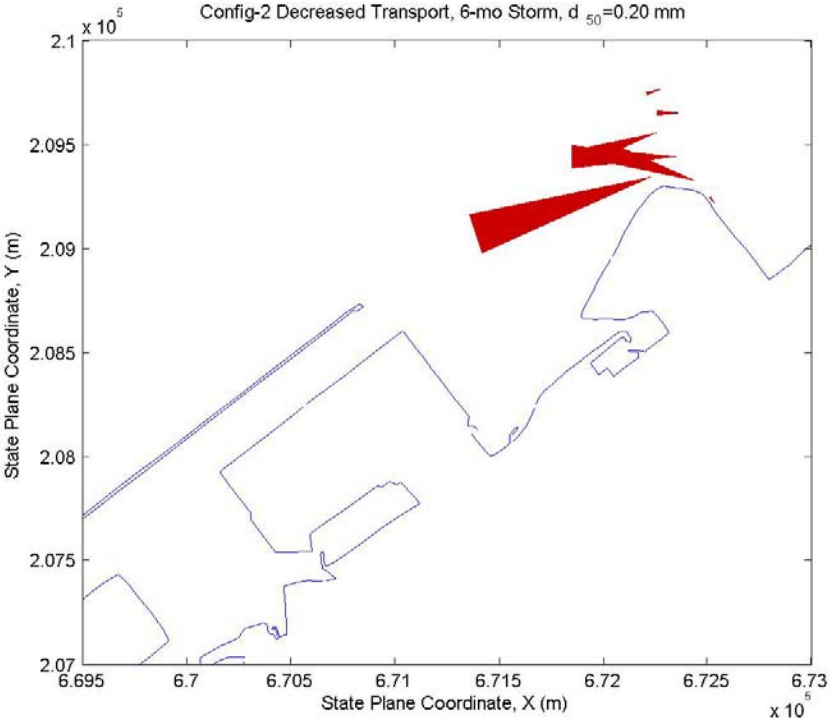


Figure C42. Configuration 2 decreased transport, 6-mo storm, d_{50}=0.20 mm

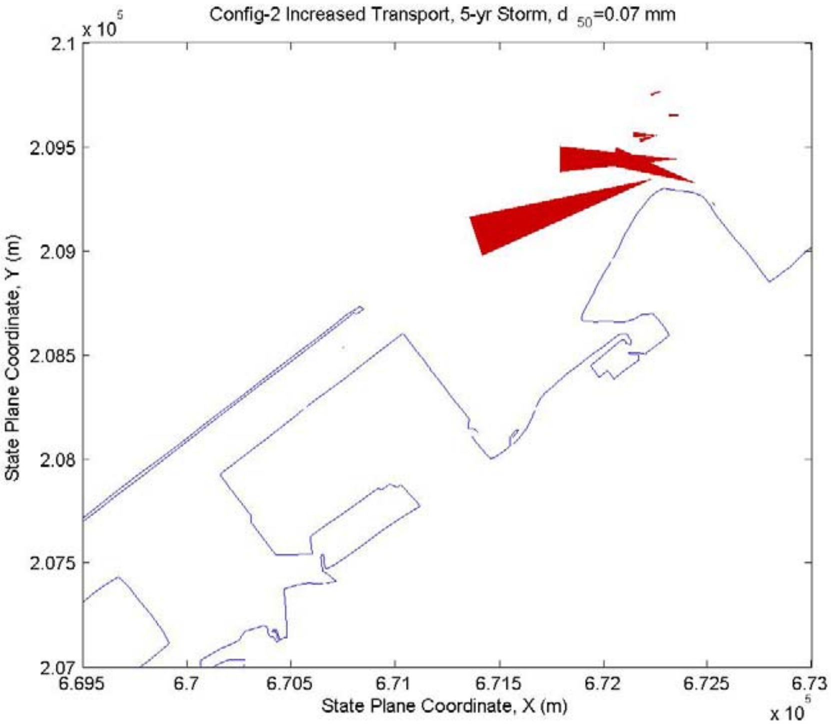


Figure C43. Configuration 2 increased transport, 5-year storm, d_{50}=0.07 mm

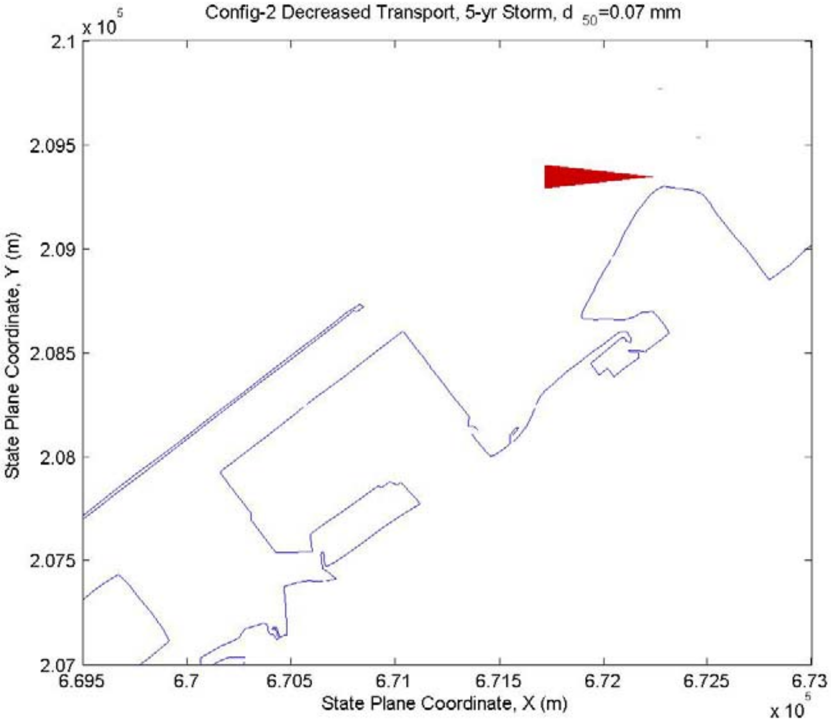


Figure C44. Configuration 2 decreased transport, 5-year storm, d_{50}=0.07 mm

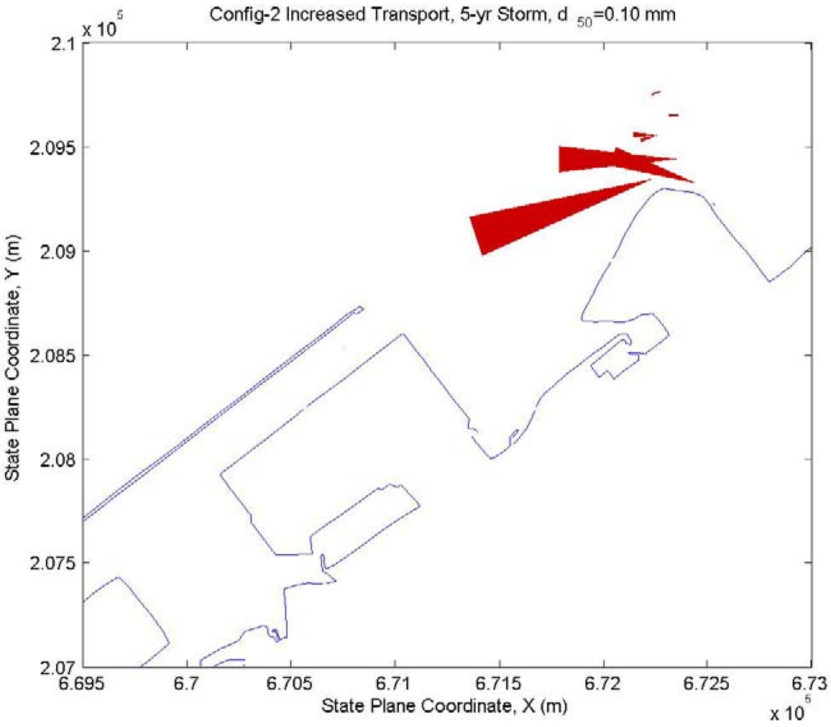


Figure C45. Configuration 2 increased transport, 5-year storm, d_{50}=0.10 mm

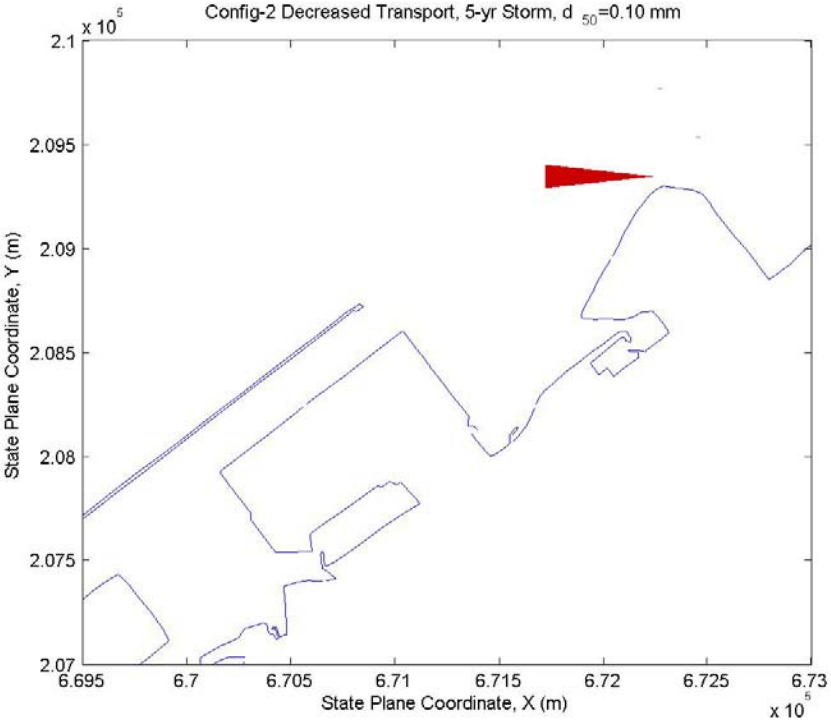


Figure C45. Configuration 2 decreased transport, 5-year storm, d_{50}=0.10 mm

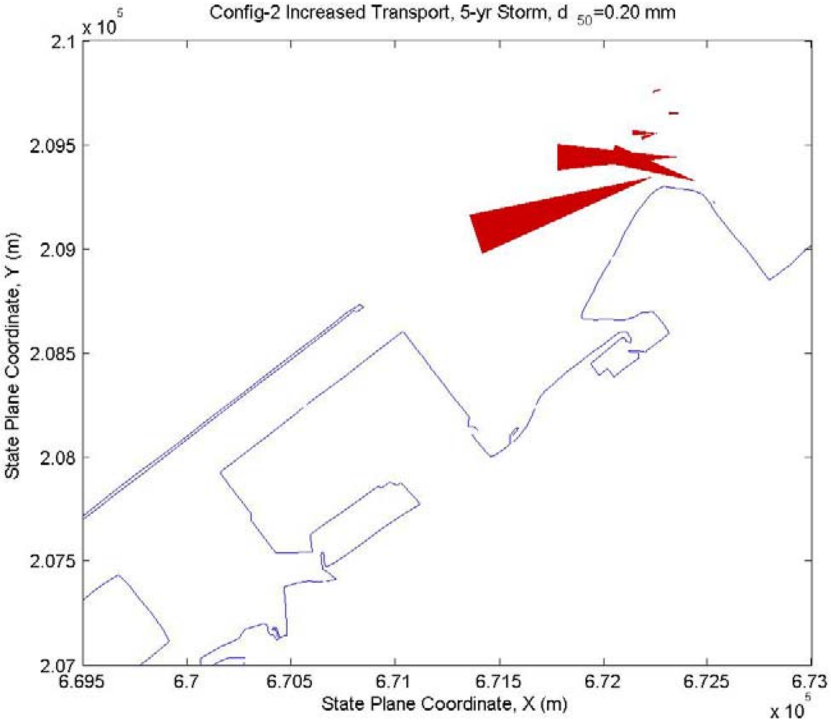


Figure C47. Configuration 2 increased transport, 5-year storm, d_{50}=0.20 mm

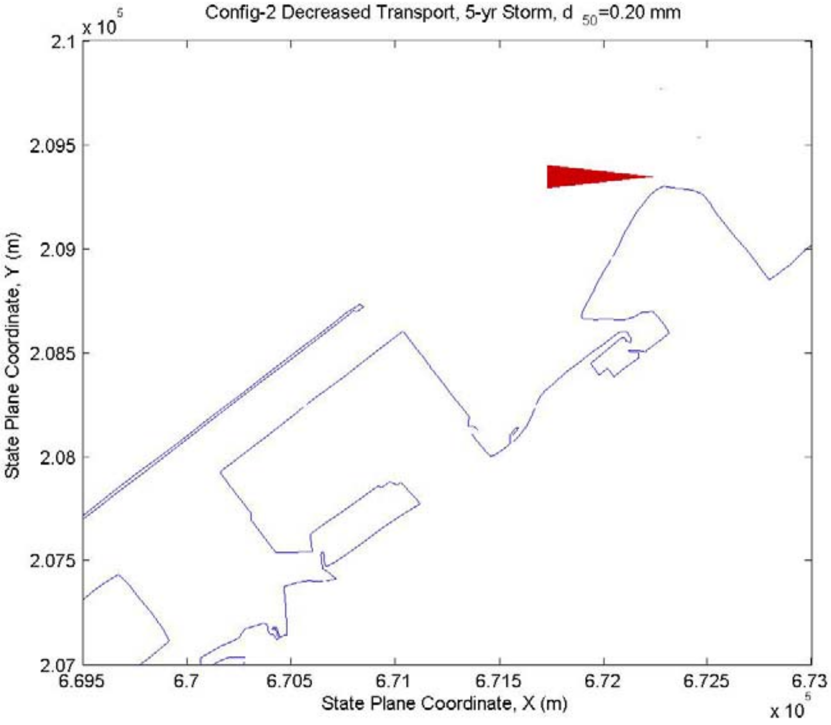


Figure C48. Configuration 2 decreased transport, 5-year storm, d_{50}=0.20 mm

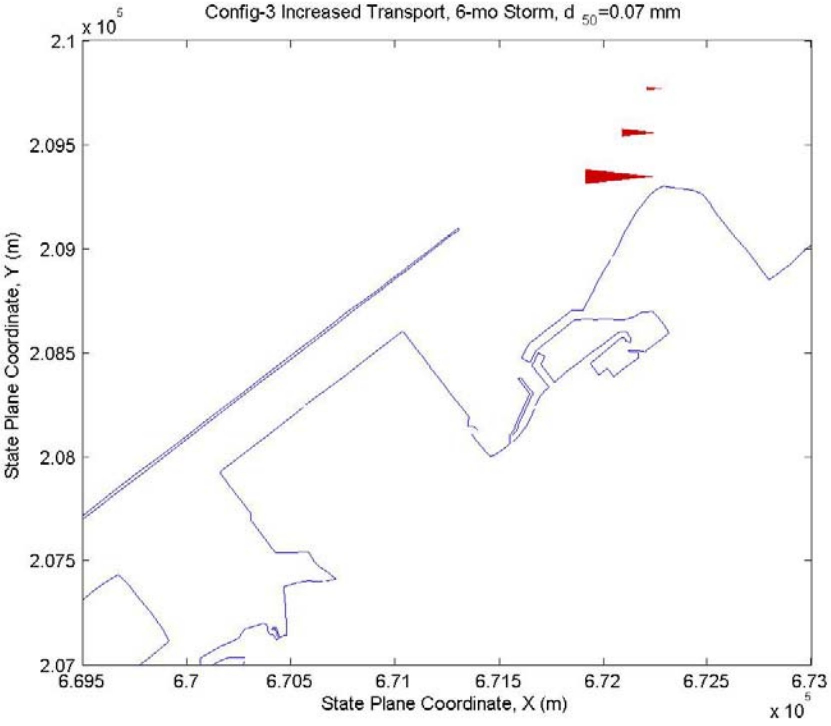


Figure C49. Configuration 3 increased transport, 6-mo storm, d_{50}=0.07 mm

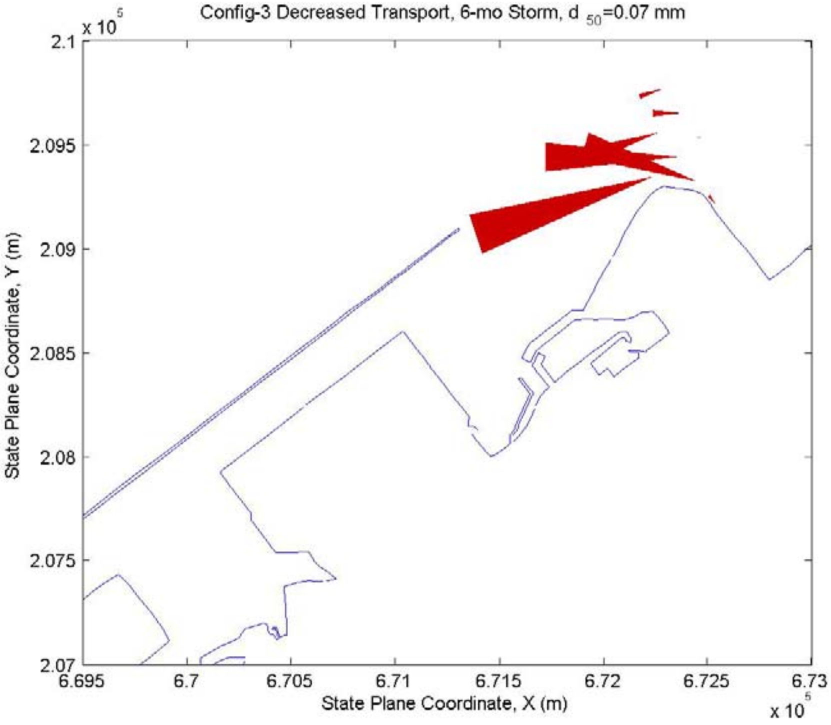


Figure C50. Configuration 3 decreased transport, 6-mo storm, d_{50}=0.07 mm

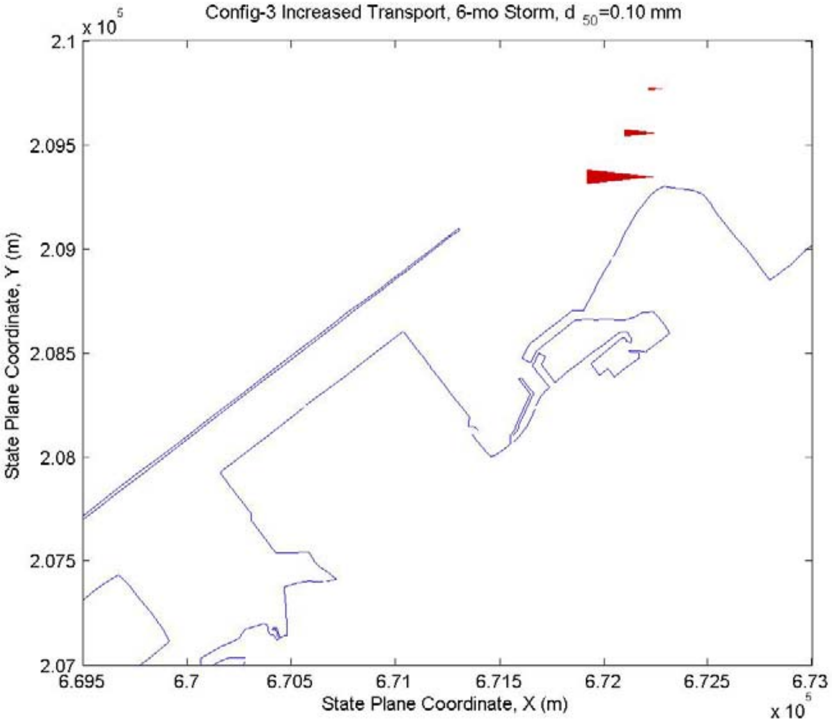


Figure C51. Configuration 3 increased transport, 6-mo storm, d_{50}=0.10 mm

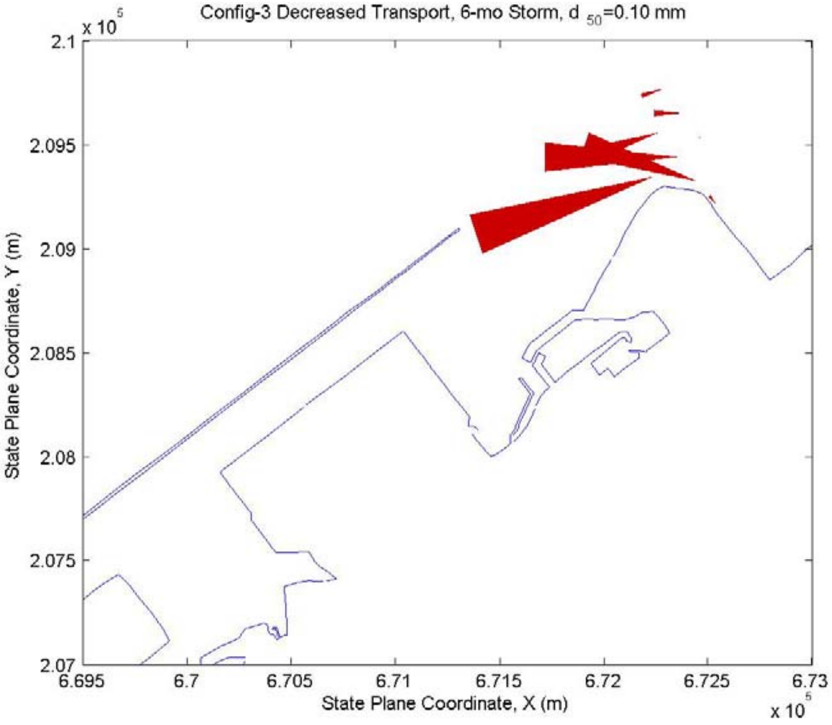


Figure C52. Configuration 3 decreased transport, 6-mo storm, d_{50}=0.10 mm

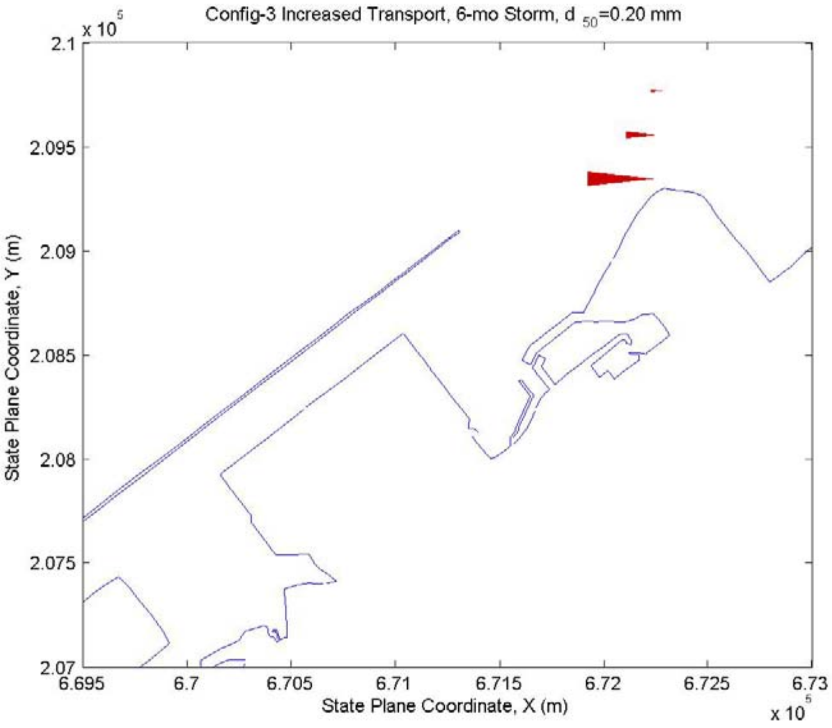


Figure C53. Configuration 3 increased transport, 6-mo storm, d_{50}=0.20 mm

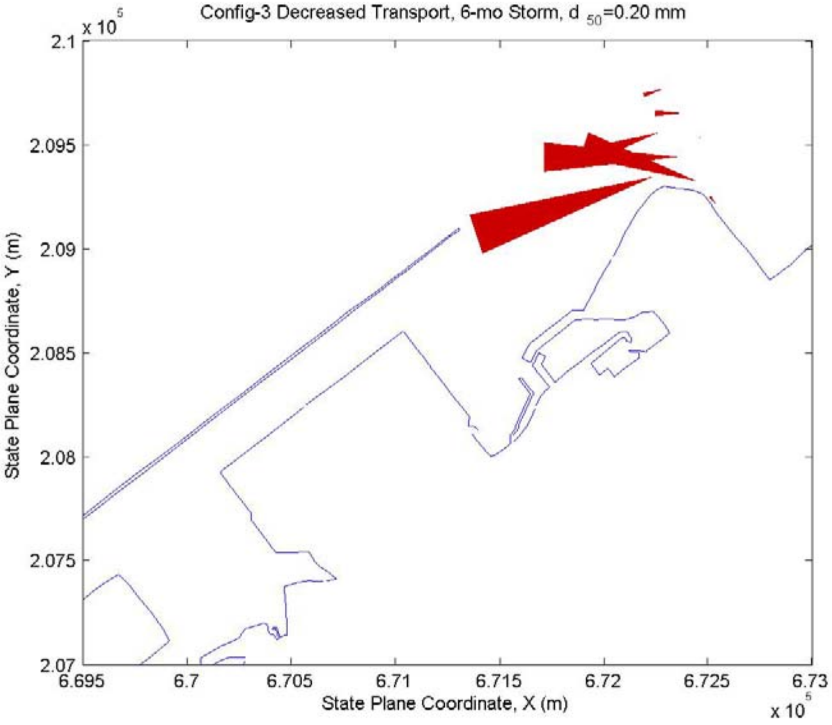


Figure C54. Configuration 3 decreased transport, 6-mo storm, d_{50}=0.20 mm

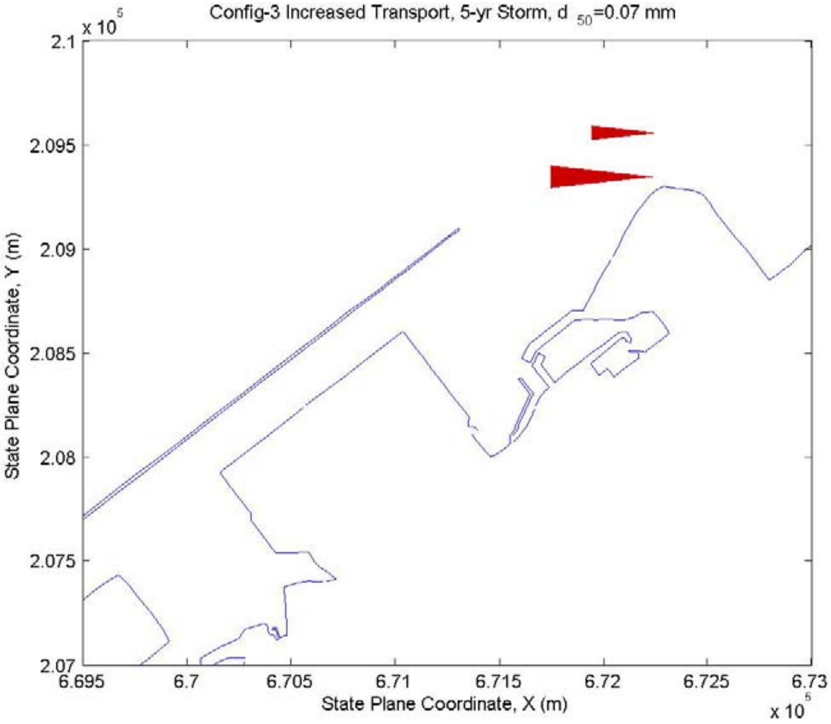


Figure C55. Configuration 3 increased transport, 5-year storm, d_{50}=0.07 mm

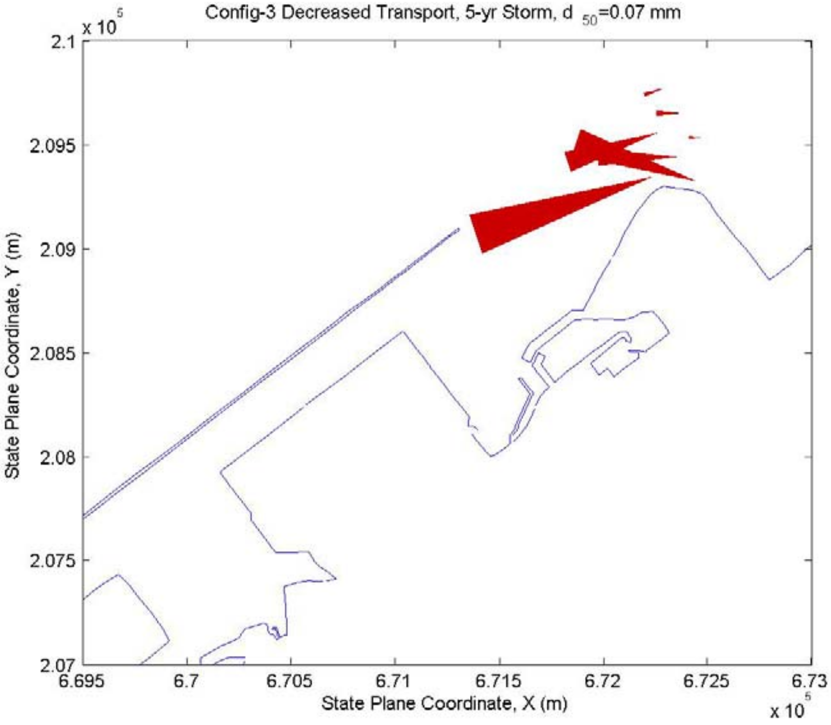


Figure C55. Configuration 3 decreased transport, 5-year storm, d_{50}=0.07 mm

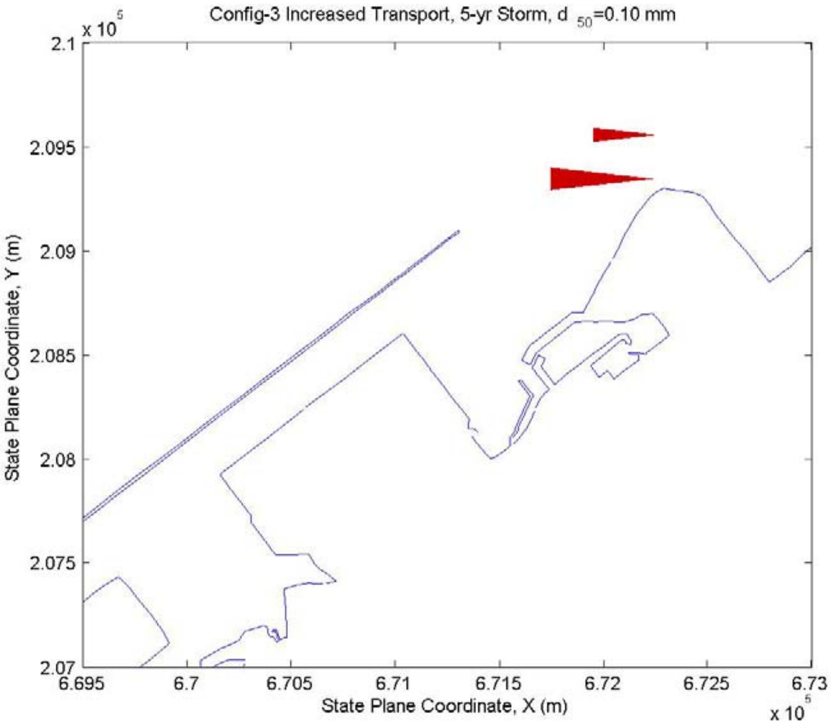


Figure C57. Configuration 3 increased transport, 5-year storm, d_{50}=0.10 mm

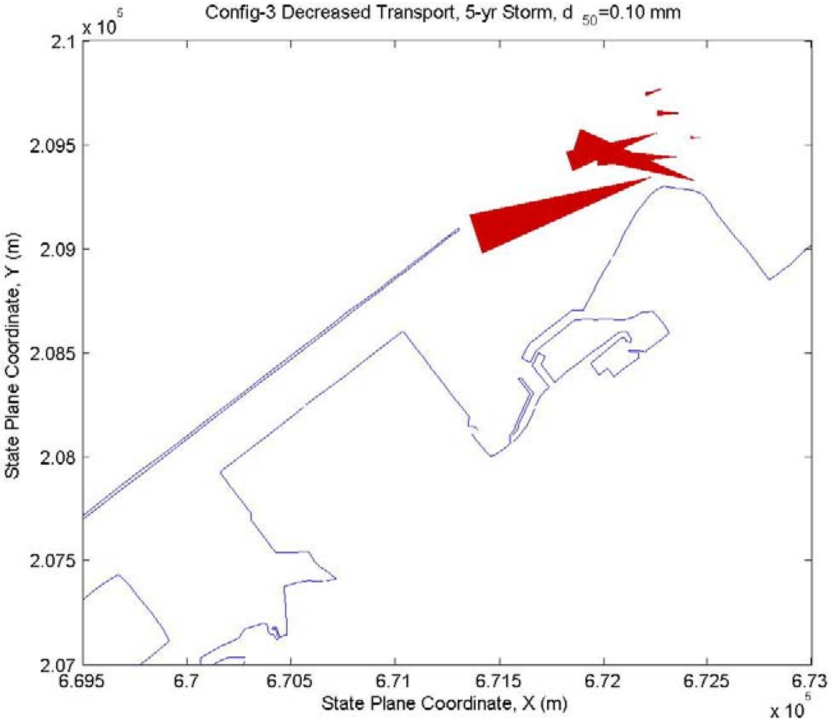


Figure C58. Configuration 3 decreased transport, 5-year storm, d_{50}=0.10 mm

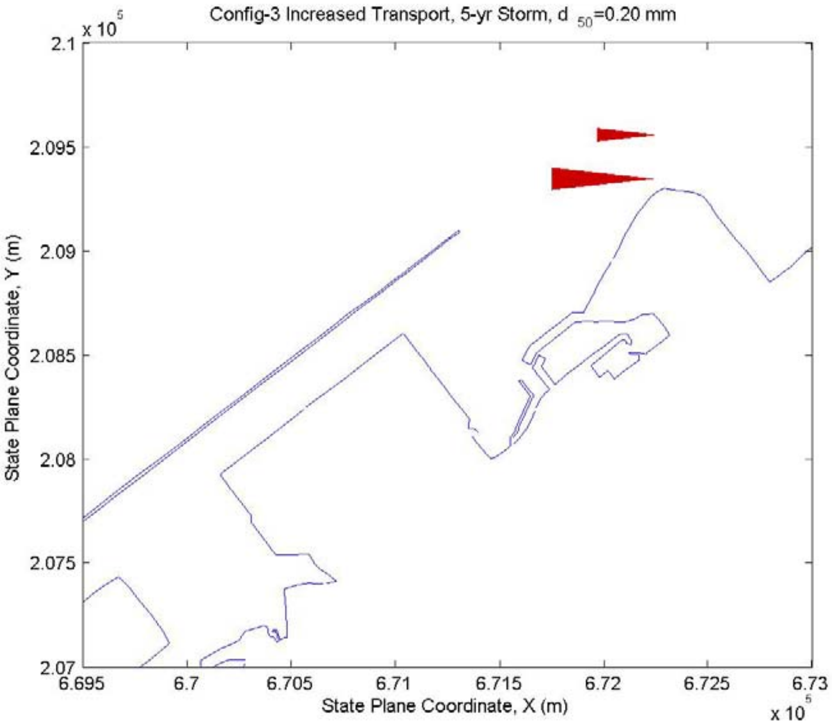


Figure C59. Configuration 3 increased transport, 5-year storm, d_{50}=0.20 mm

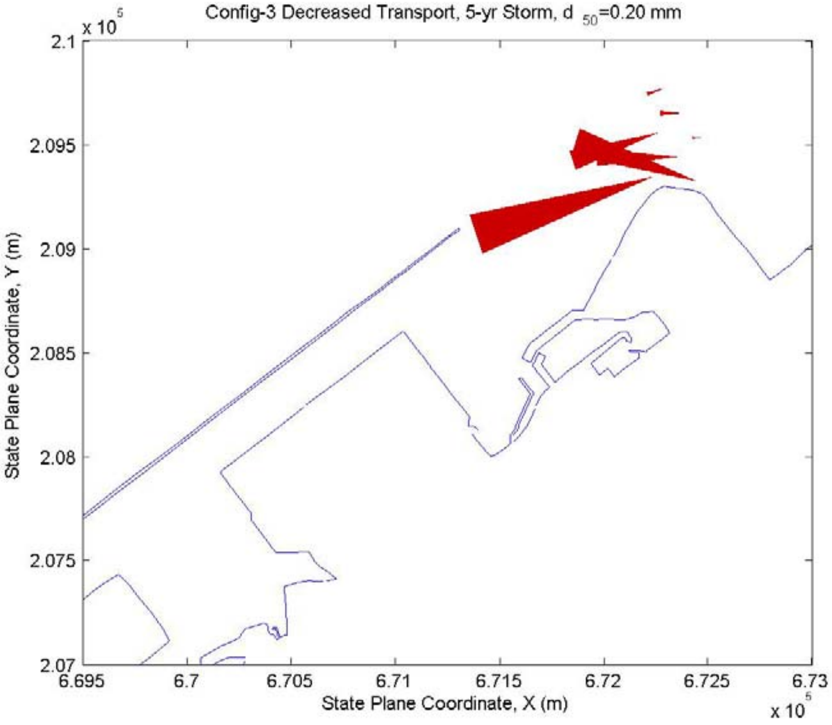


Figure C60. Configuration 3 decreased transport, 5-year storm, d_{50}=0.20 mm

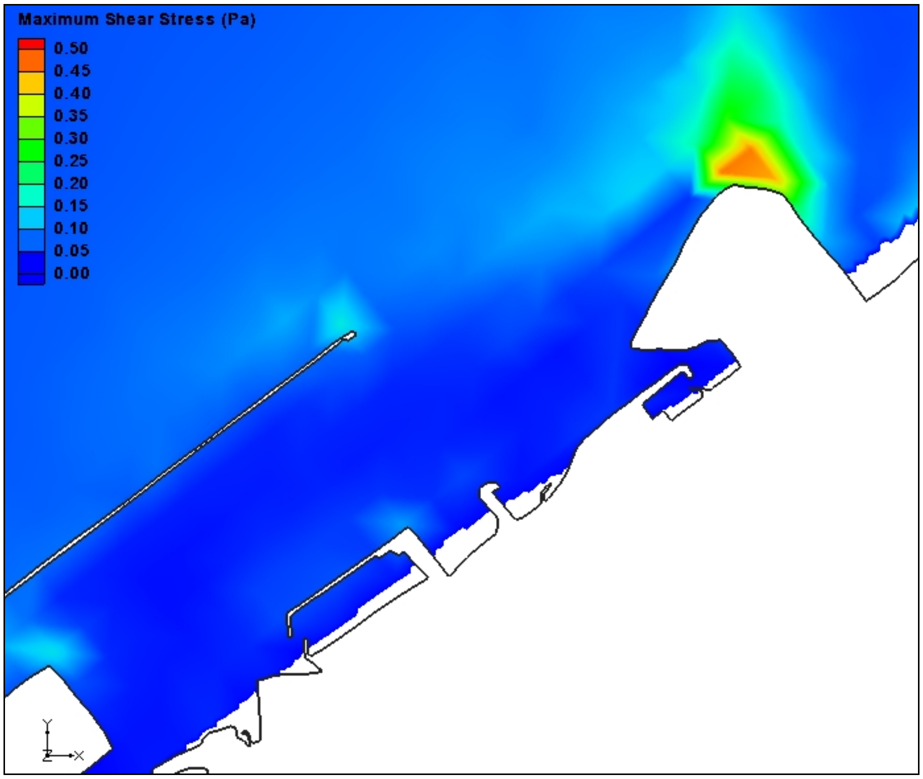


Figure C61. Maximum shear stress, Base condition, 6-month storm

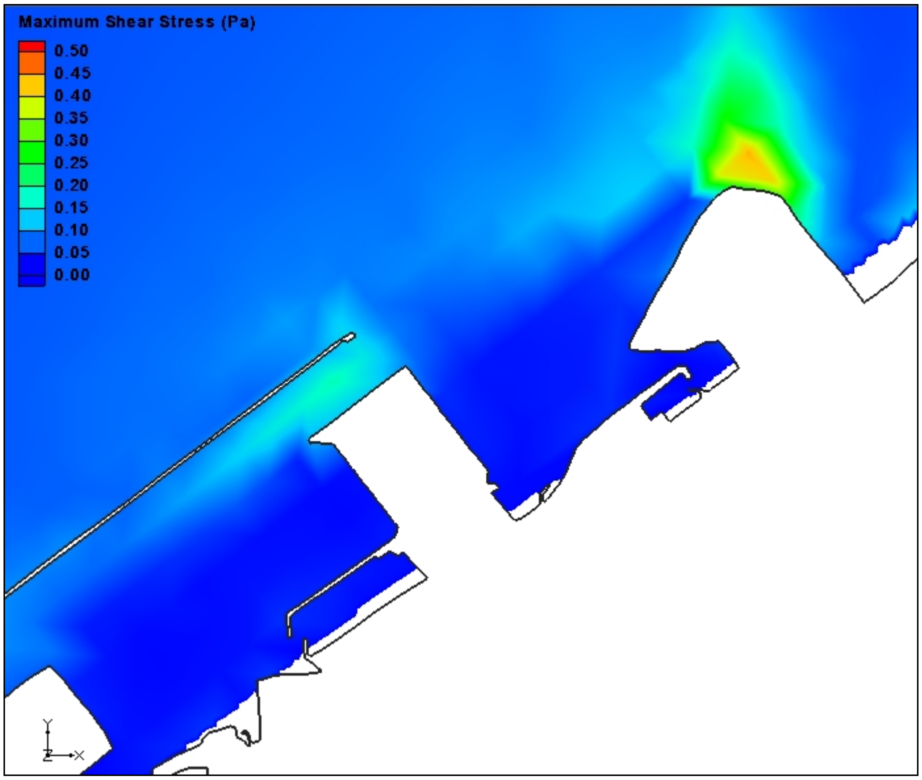


Figure C62. Maximum shear stress, Configuration 1, 6-month storm

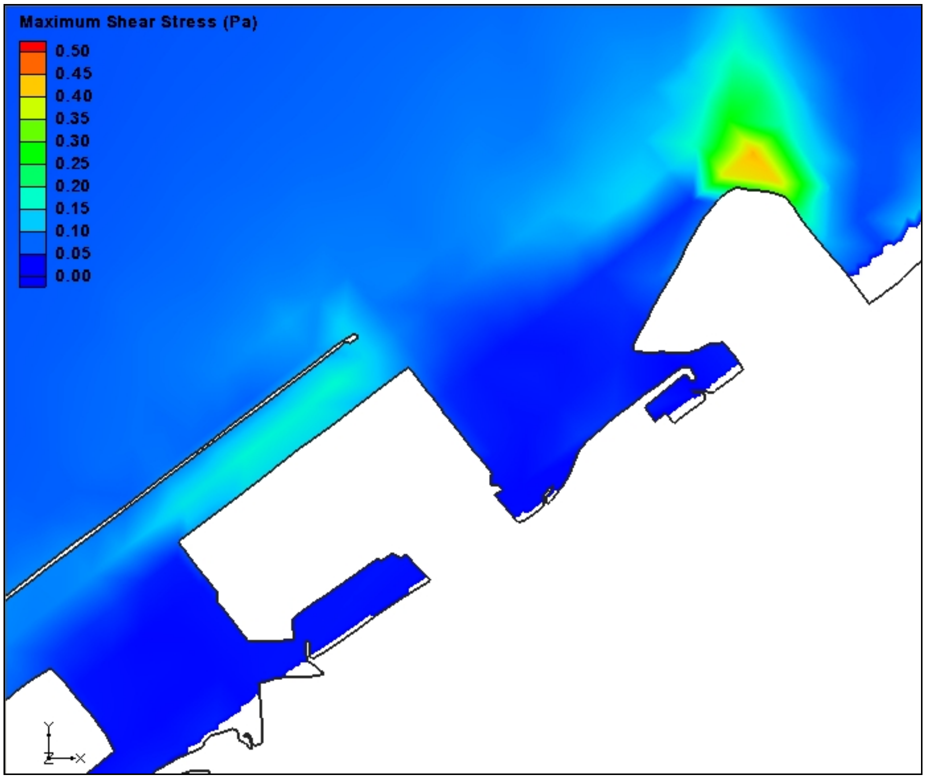


Figure C63. Maximum shear stress, Configuration 2, 6-month storm

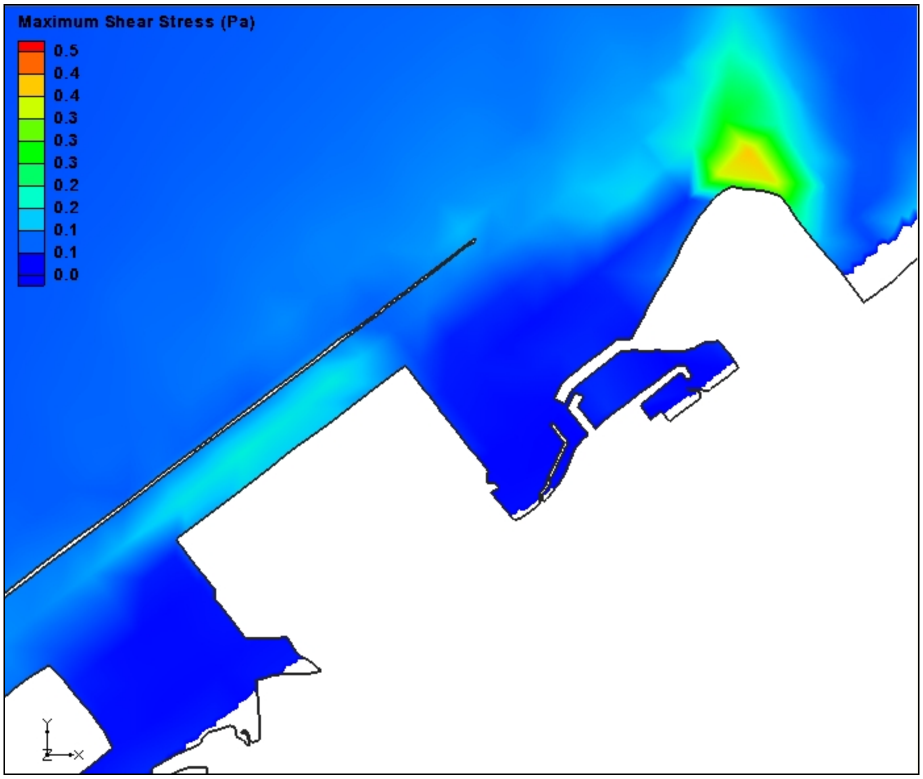


Figure C64. Maximum shear stress, Configuration 3, 6-month storm

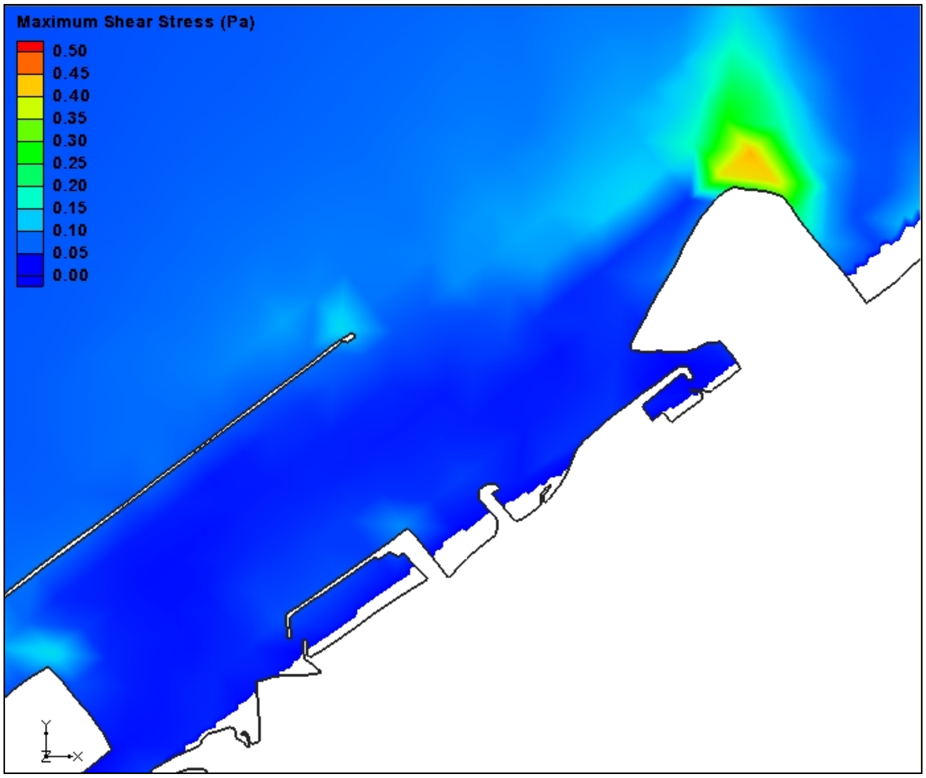


Figure C65. Maximum shear stress, Base condition, 5-year storm

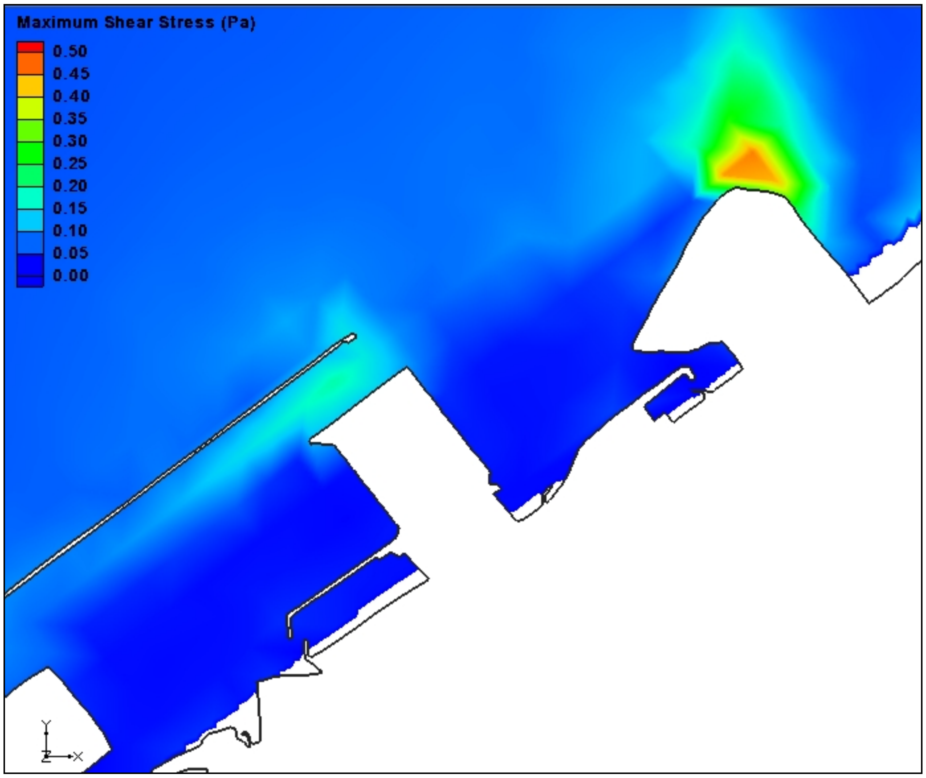


Figure C66. Maximum shear stress, Configuration 1, 5-year storm

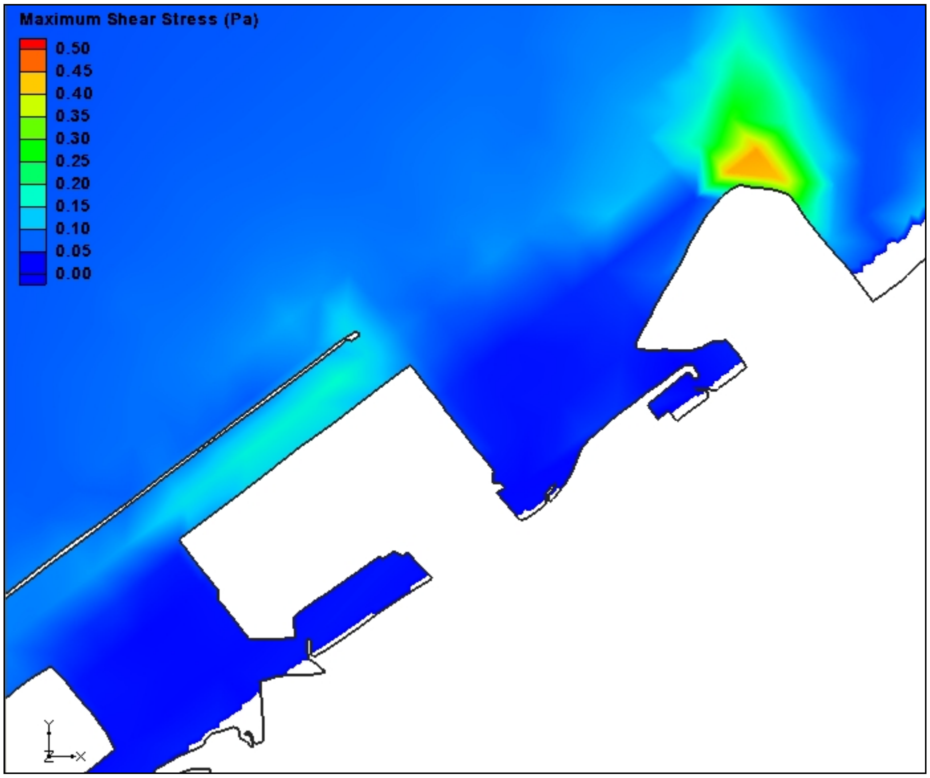


Figure C67. Maximum shear stress, Configuration 2, 5-year storm

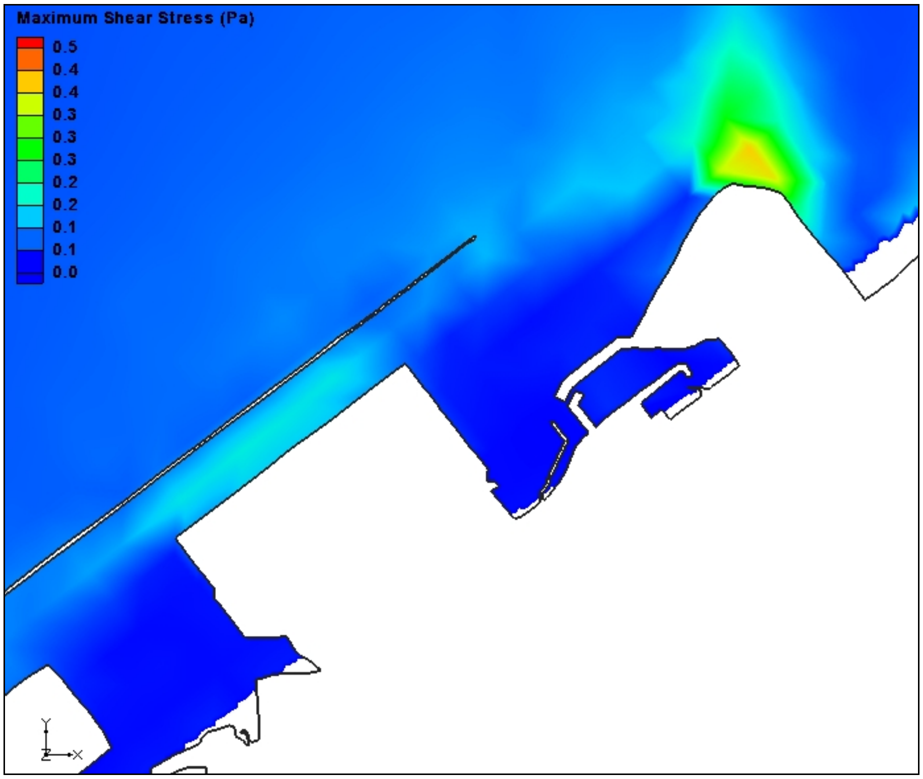


Figure C68. Maximum shear stress, Configuration 3, 5-year storm

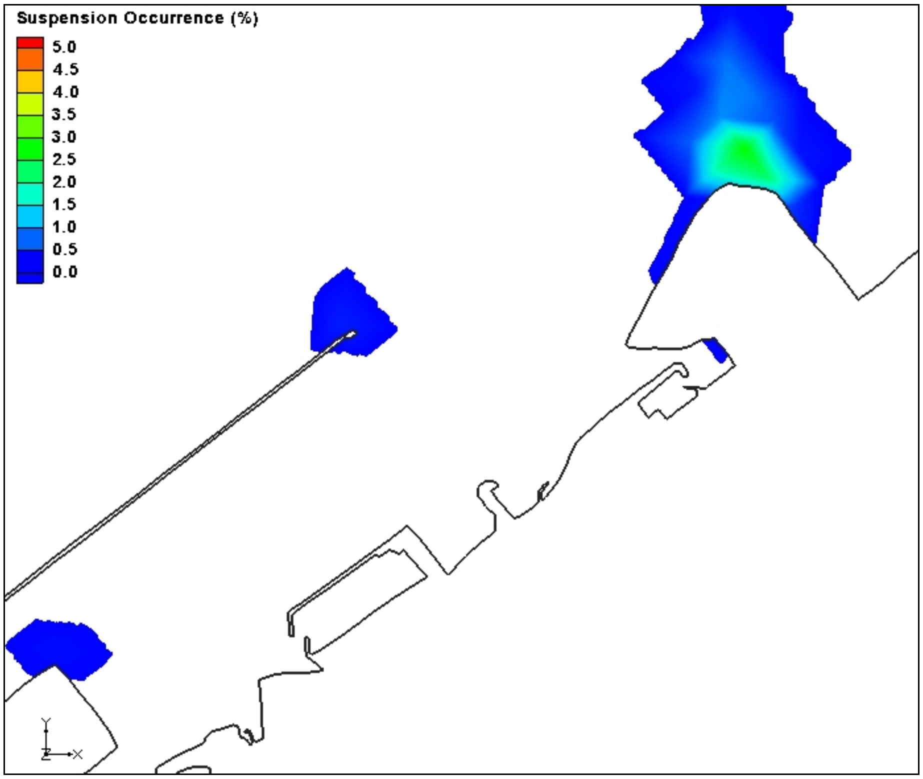


Figure C69. Percent of suspension occurrences, Base condition, 6-month storm

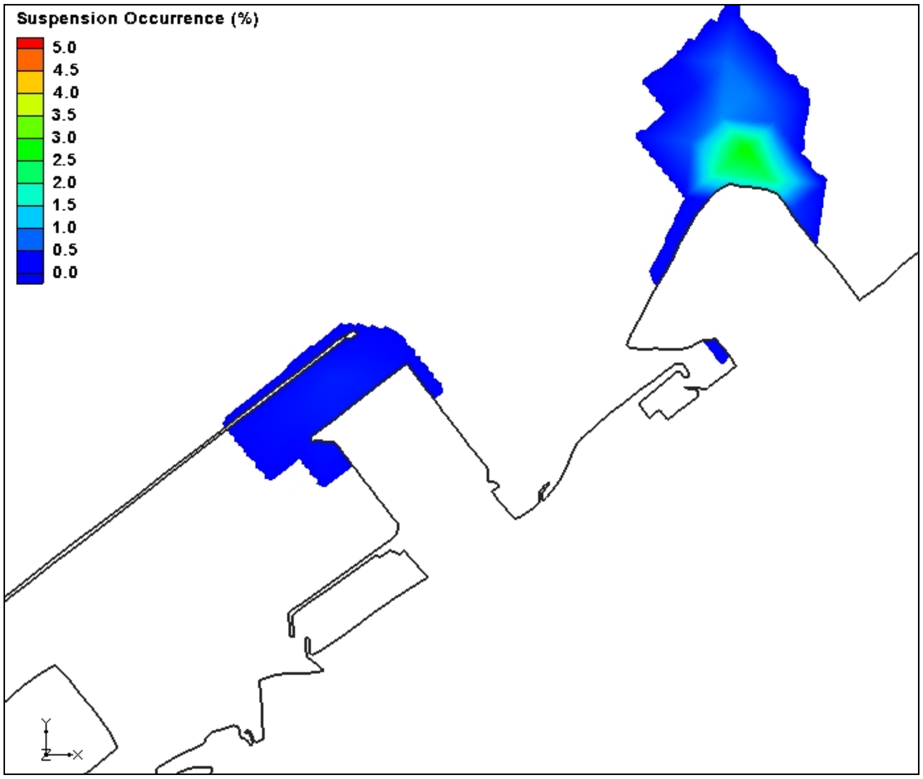


Figure C70. Percent of suspension occurrences, Configuration 1, 6-month storm

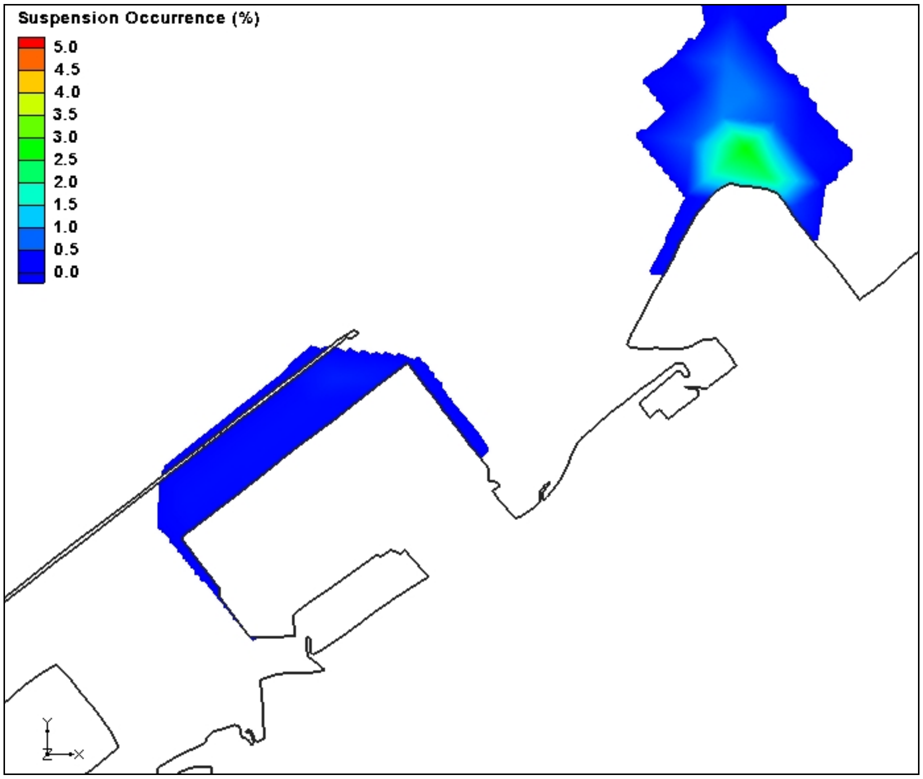


Figure C71. Percent of suspension occurrences, Configuration 2, 6-month storm

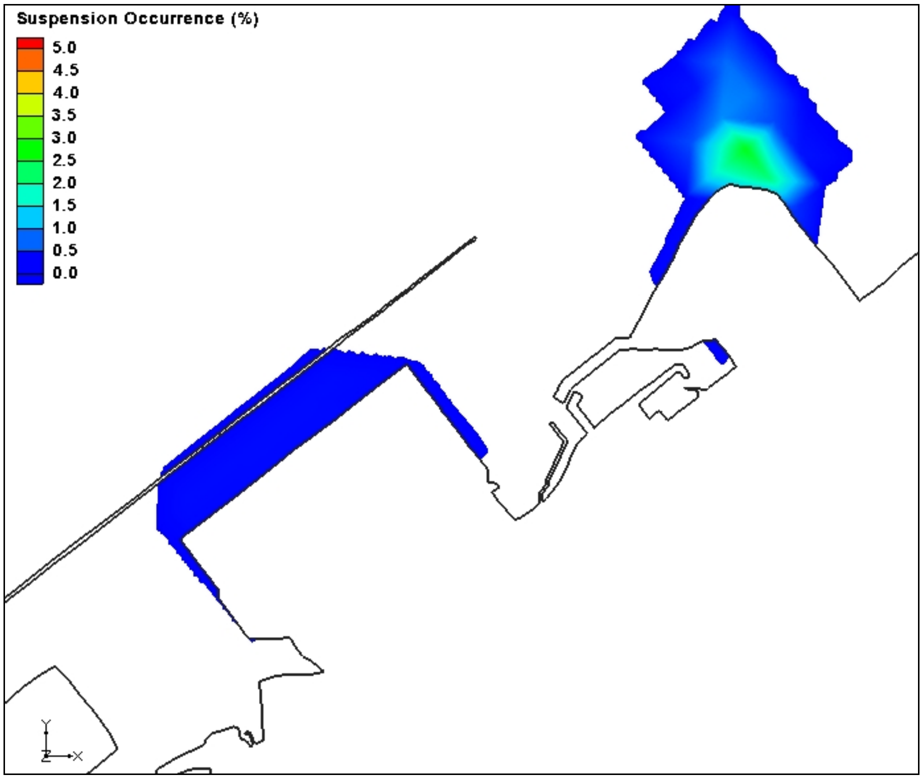


Figure C72. Percent of suspension occurrences, Configuration 3, 6-month storm

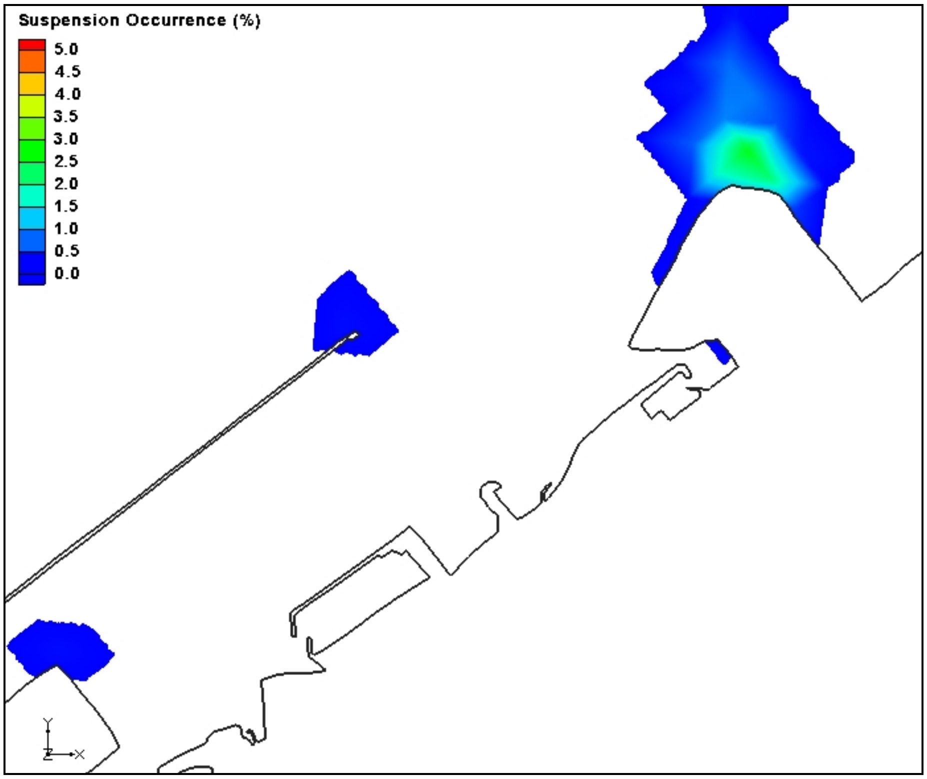


Figure C73. Percent of suspension occurrences, Base condition, 5-year storm

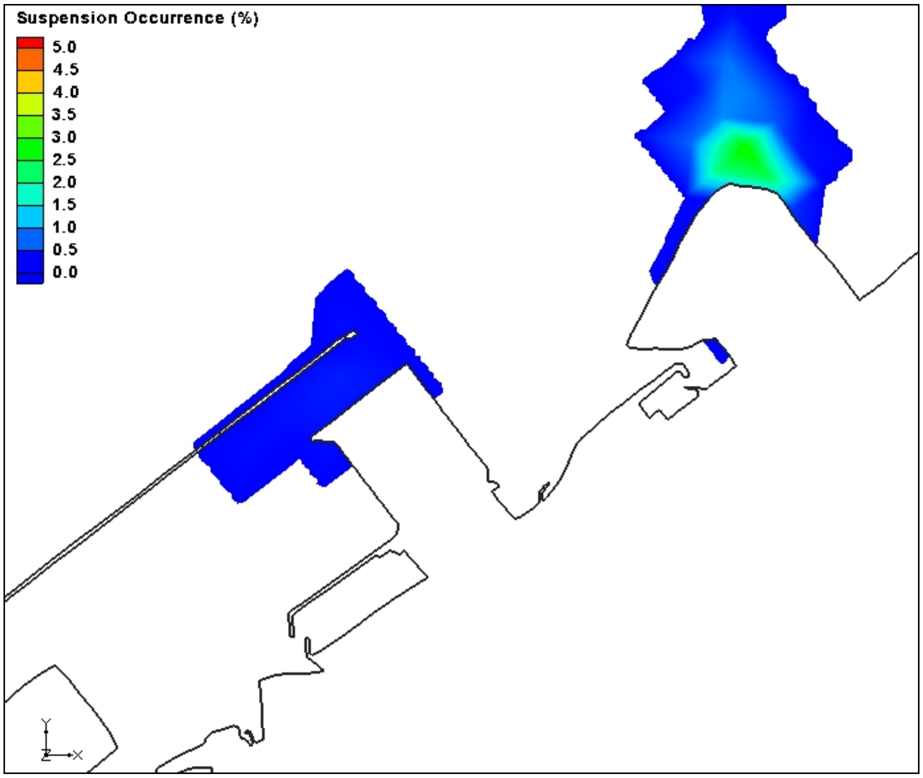


Figure C74. Percent of suspension occurrences, Configuration 1, 5-year storm

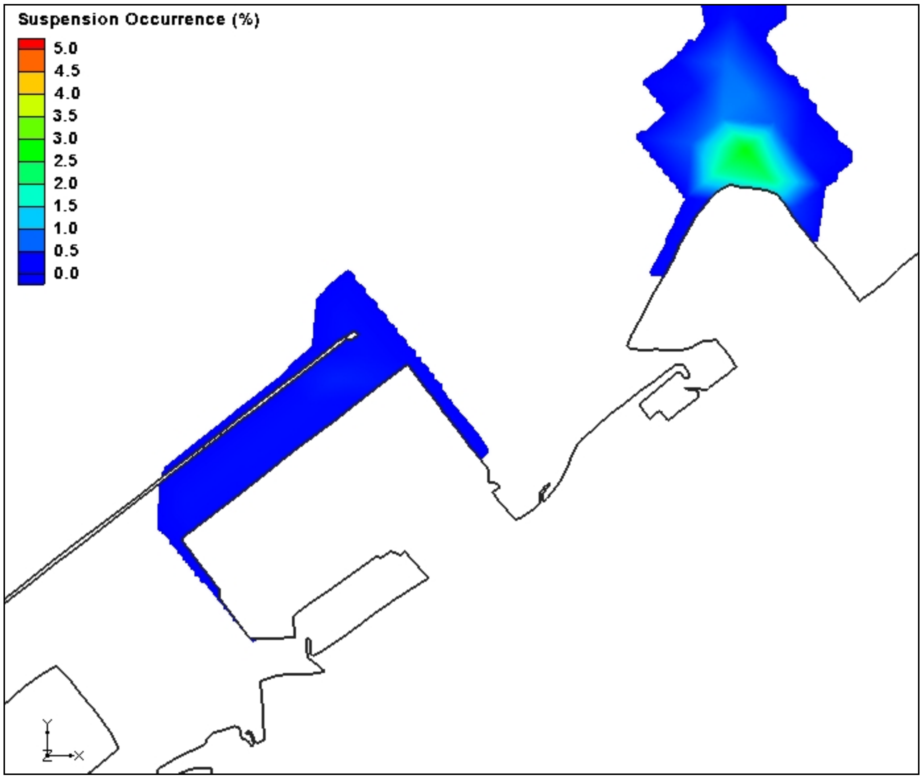


Figure C75. Percent of suspension occurrences, Configuration 2, 5-year storm

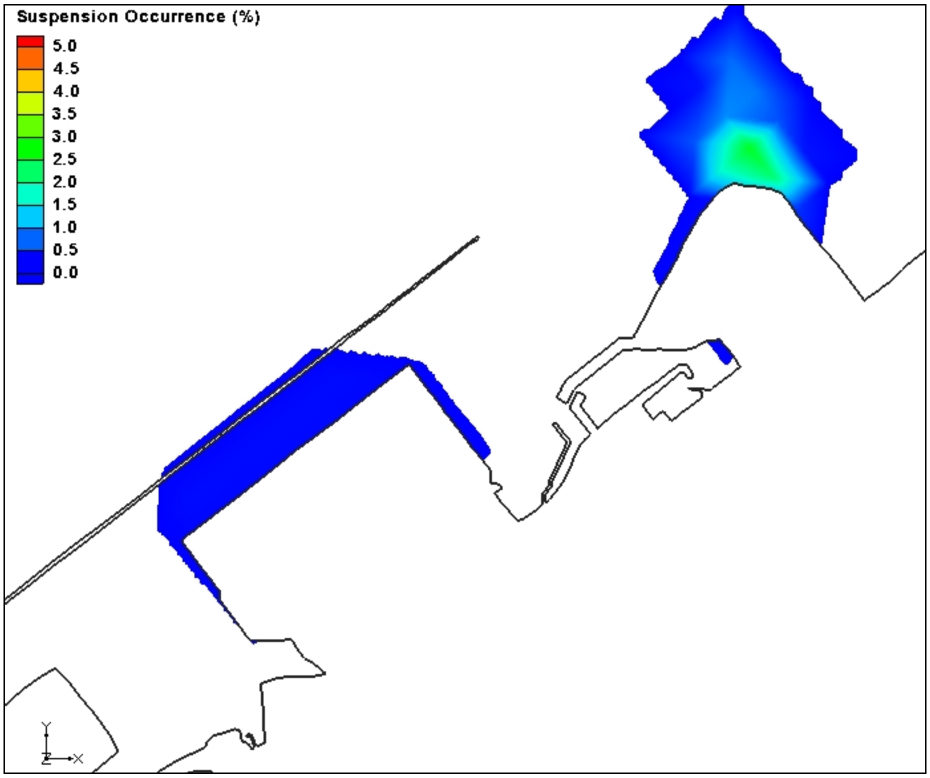


Figure C76. Percent of suspension occurrences, Configuration 3, 5-year storm

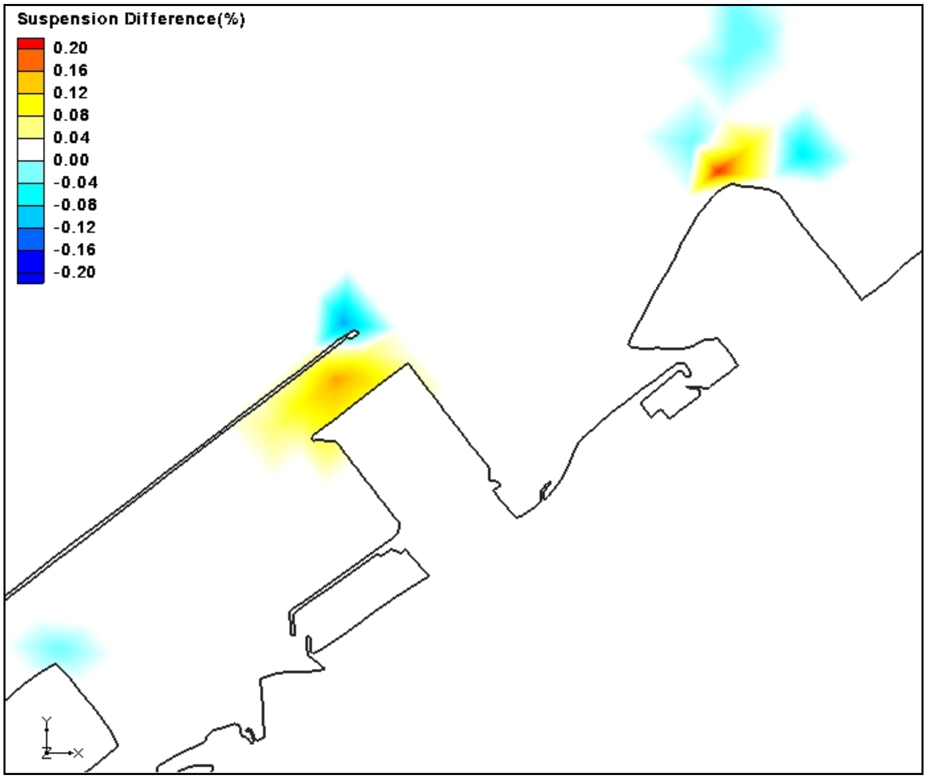


Figure C77. Difference in percent suspension, Configuration 1, 6-month storm

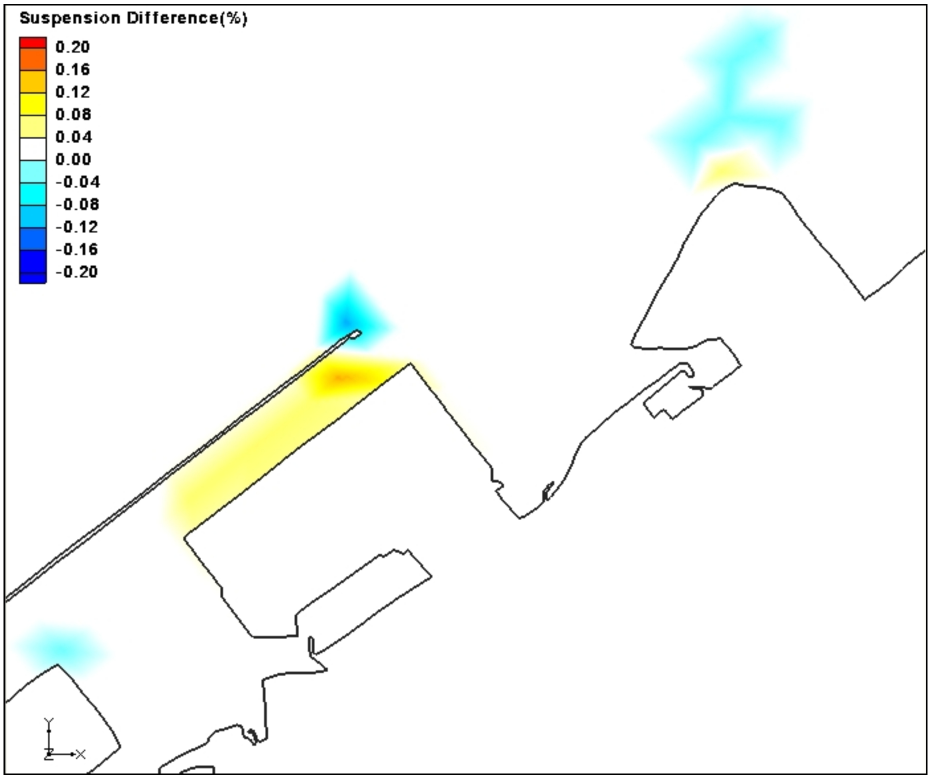


Figure C78. Difference in percent suspension, Configuration 2, 6-month storm

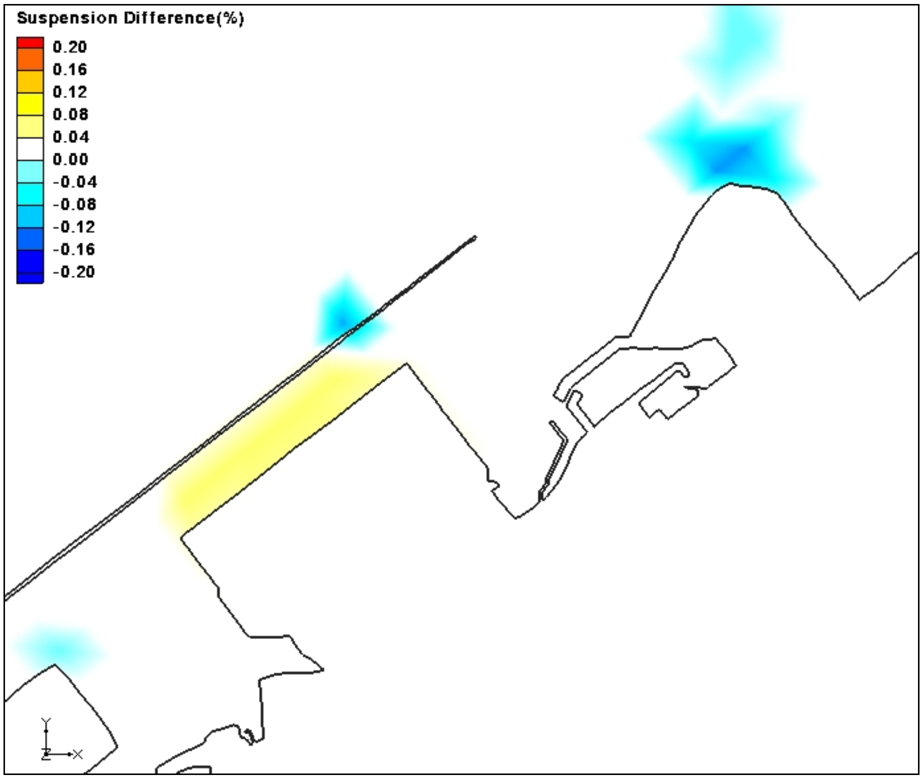


Figure C79. Difference in percent suspension, Configuration 3, 6-month storm

Figure C80. Difference in percent suspension, Configuration 1, 5-year storm

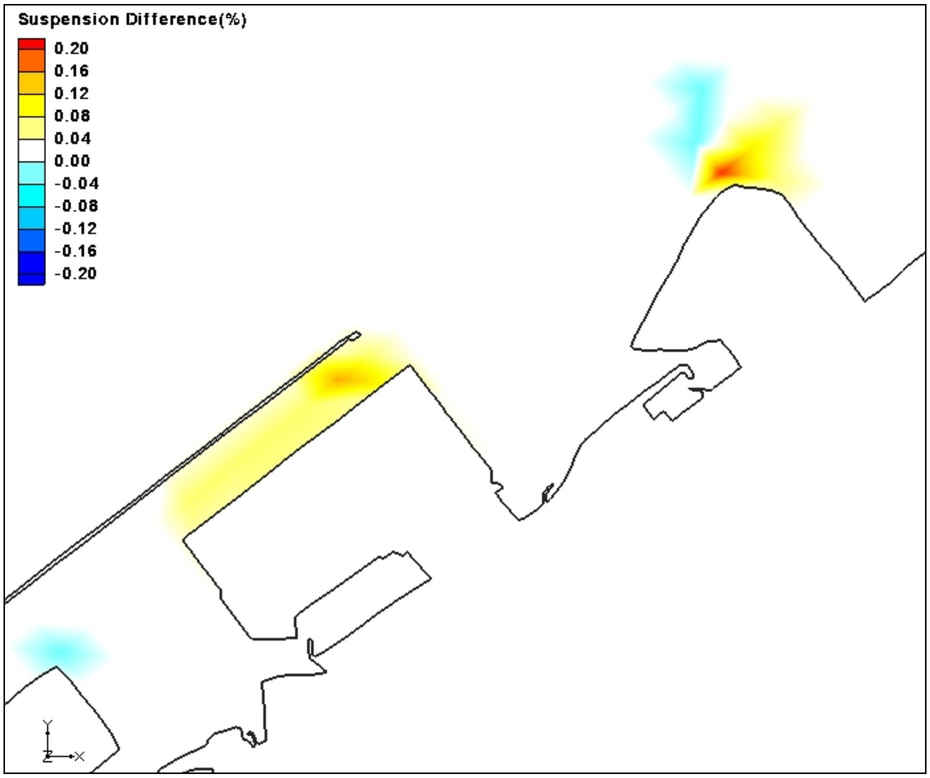


Figure C81. Difference in percent suspension, Configuration 2, 5-year storm

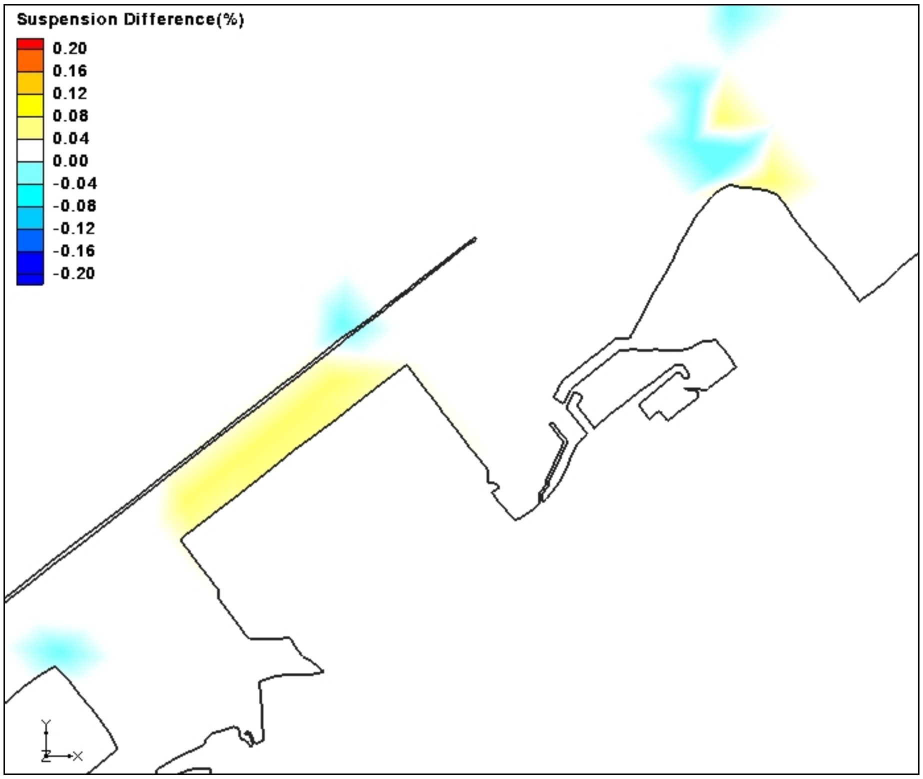


Figure C82. Difference in percent suspension, Configuration 3, 5-year storm

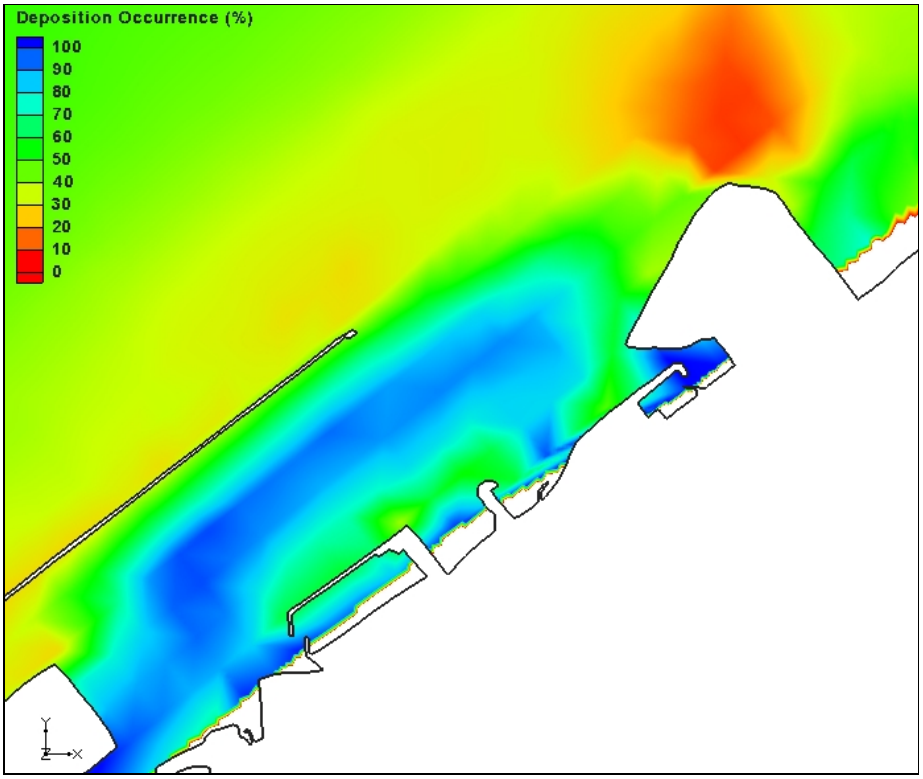


Figure C83. Percent of deposition occurrences, Base condition, 6-month storm

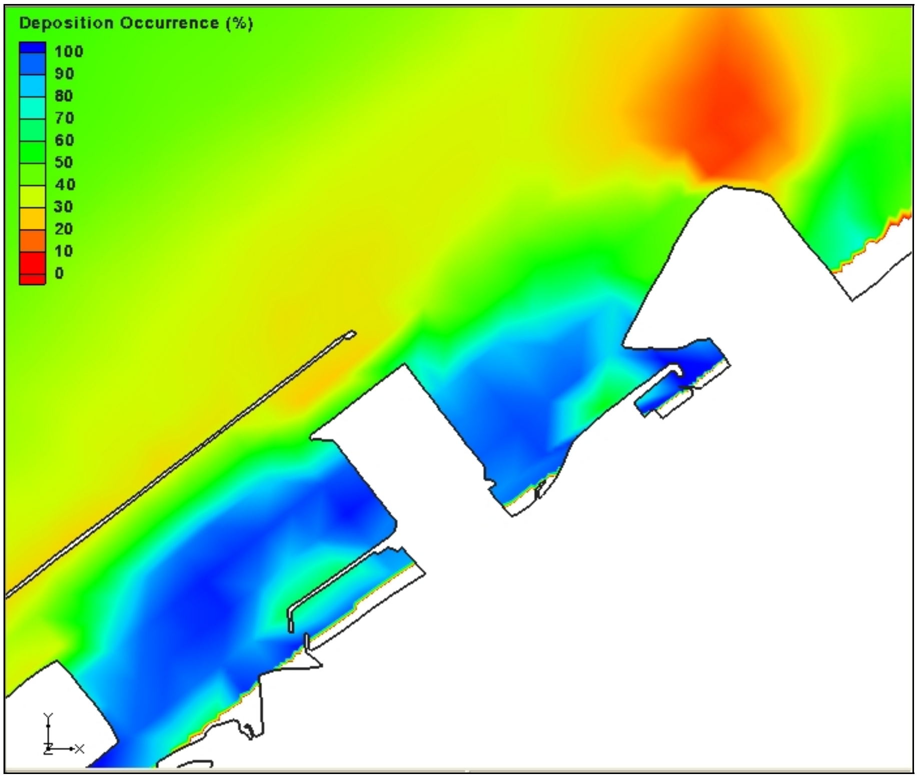


Figure C84. Percent of deposition occurrences, Configuration 1, 6-month storm

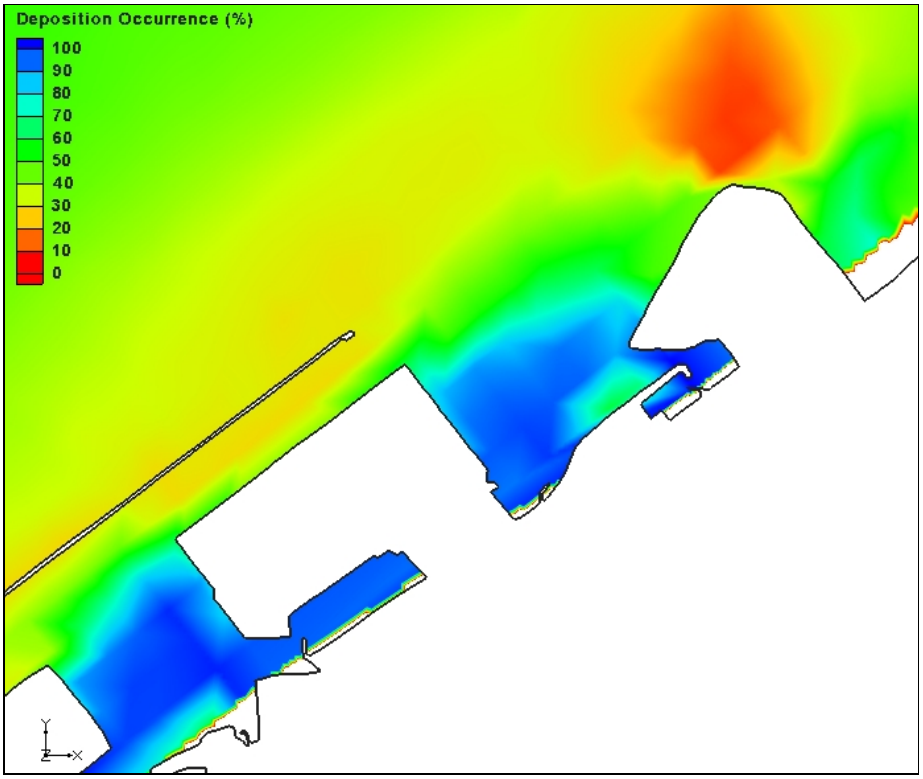


Figure C85. Percent of deposition occurrences, Configuration 2, 6-month storm

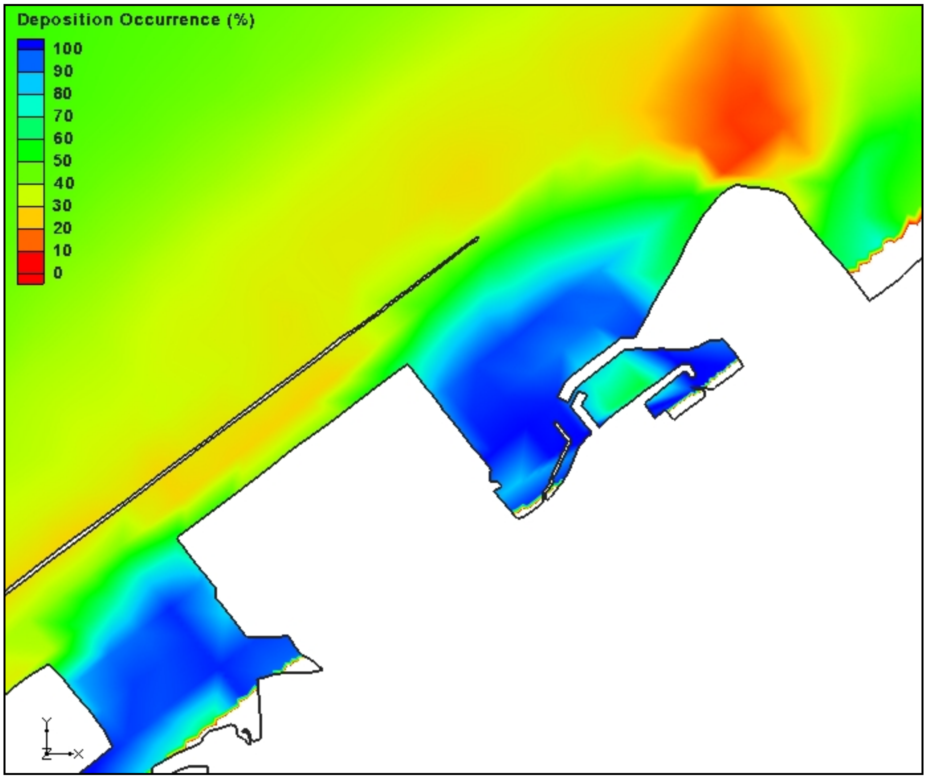


Figure C86. Percent of deposition occurrences, Configuration 3, 6-month storm

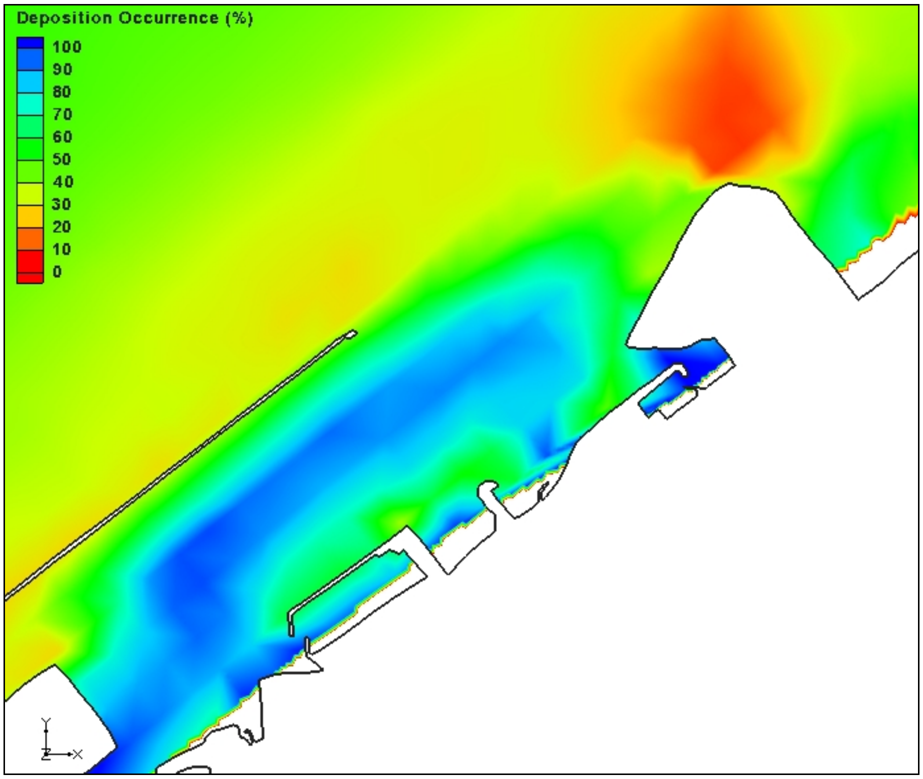


Figure C87. Percent of deposition occurrences, Base condition, 5-year storm

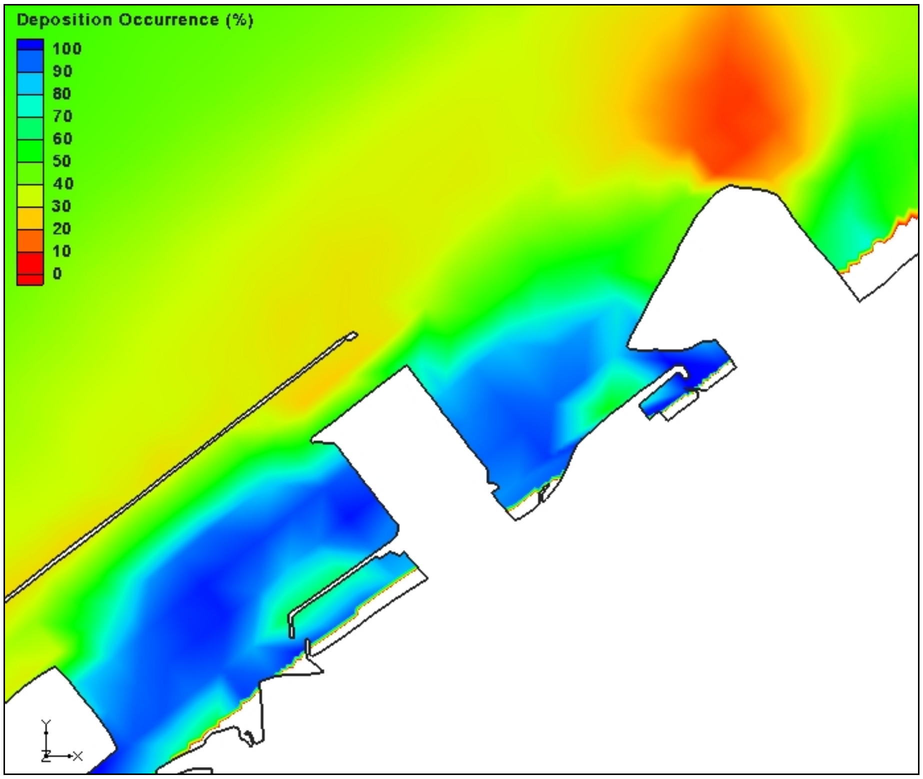


Figure C88. Percent of deposition occurrences, Configuration 1, 5-year storm

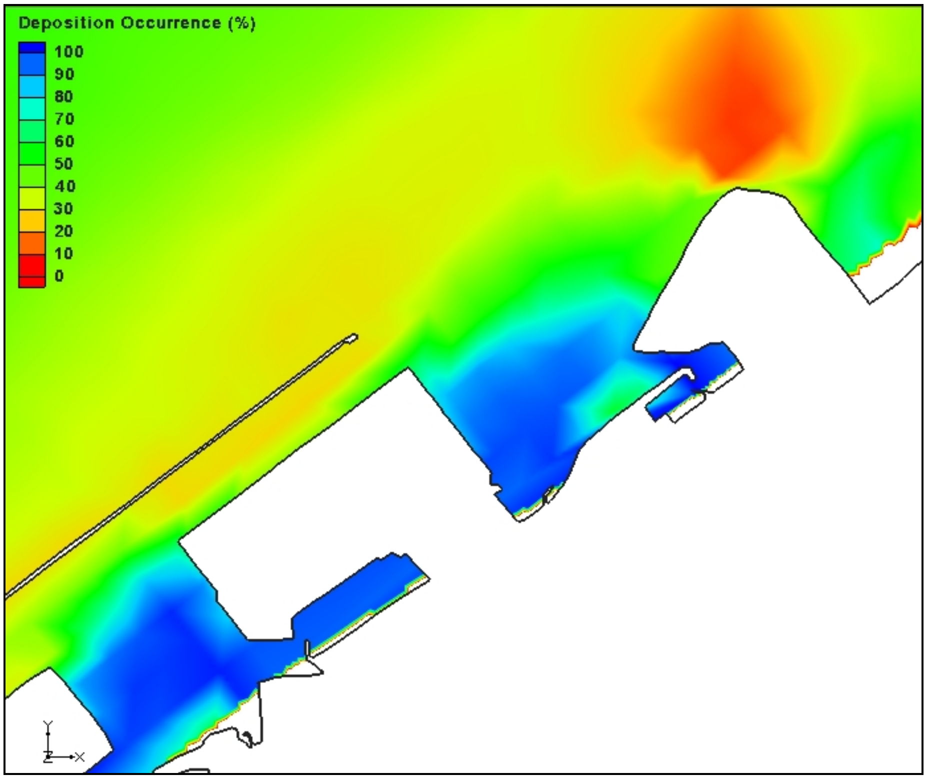


Figure C89. Percent of deposition occurrences, Configuration 2, 5-year storm

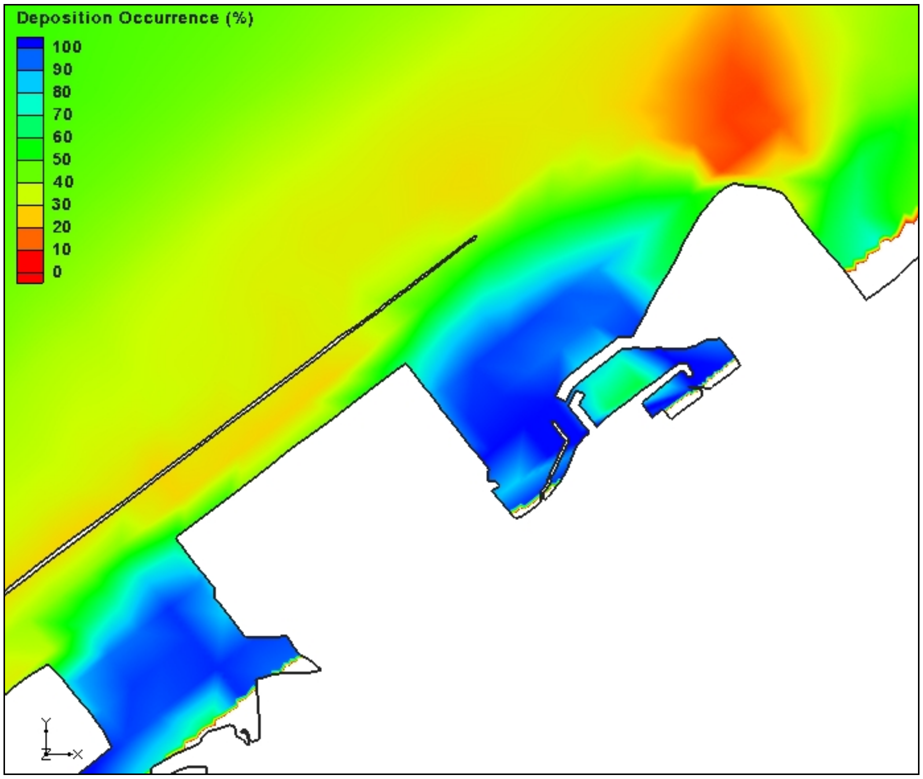


Figure C90. Percent of deposition occurrences, Configuration 3, 5-year storm

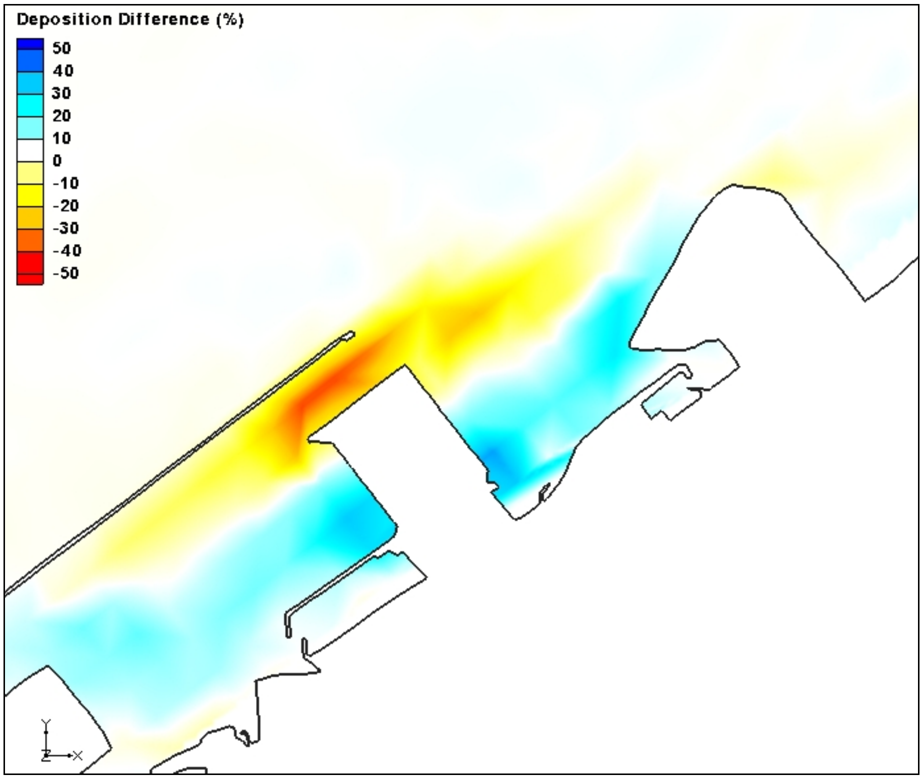


Figure C91. Difference in percent deposition, Configuration 1, 6-month storm

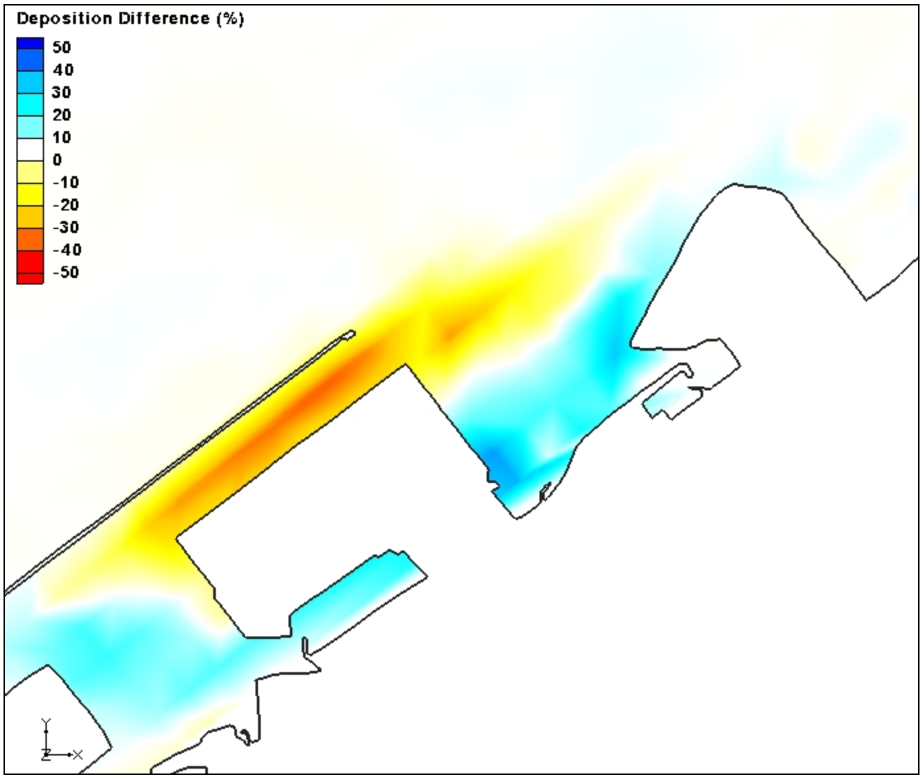


Figure C92. Difference in percent deposition, Configuration 2, 6-month storm

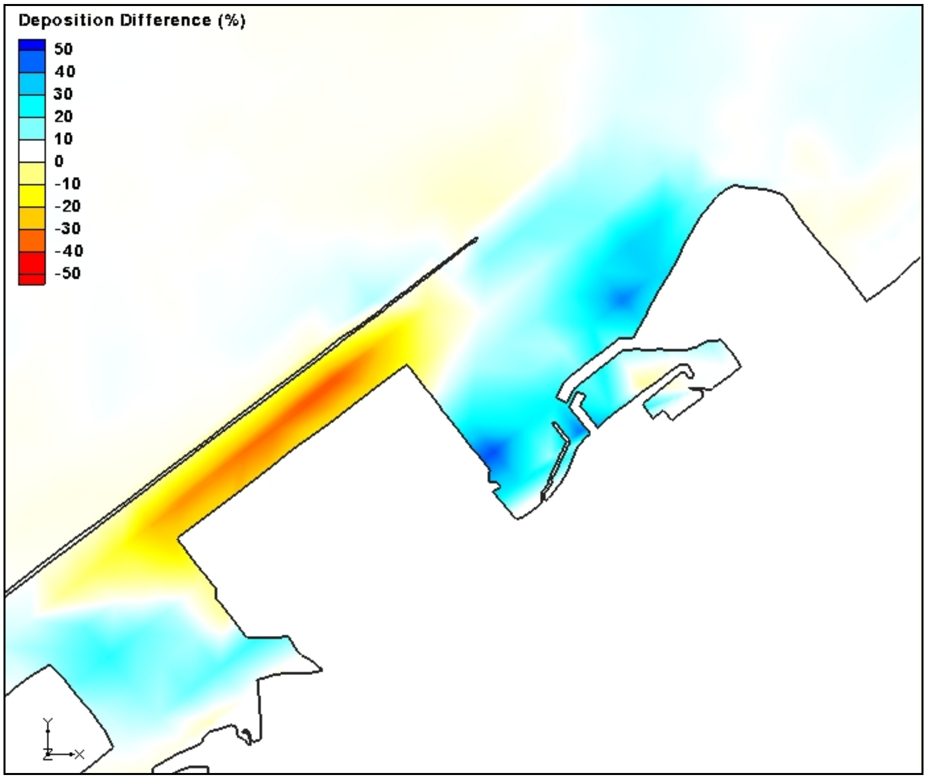


Figure C93. Difference in percent deposition, Configuration 3, 6-month storm

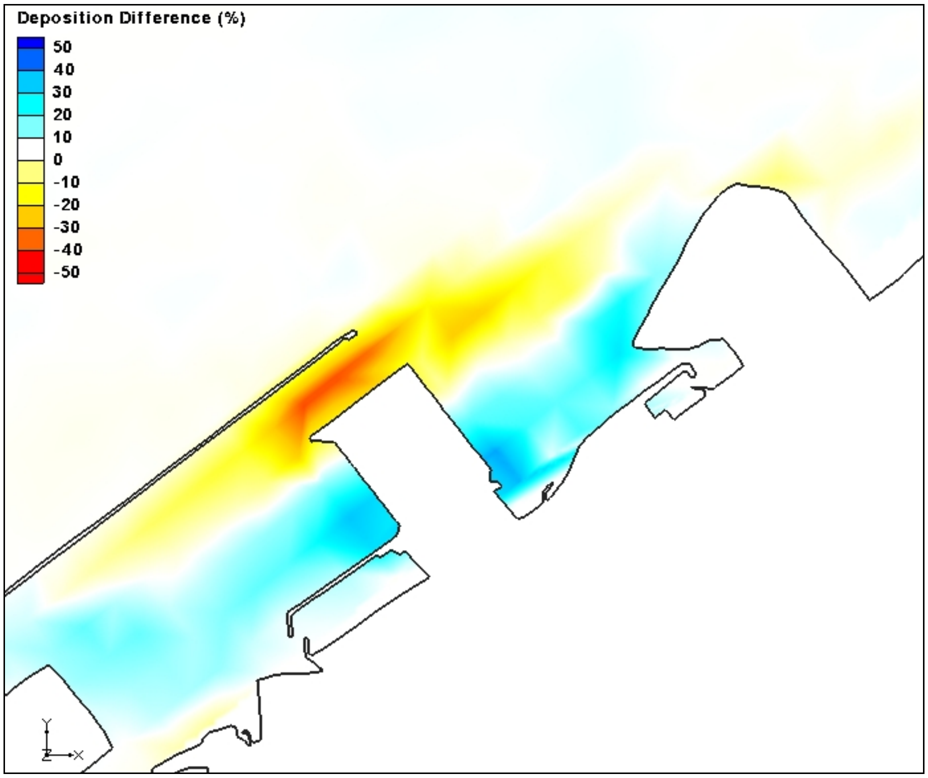


Figure C94. Difference in percent deposition, Configuration 1, 5-year storm

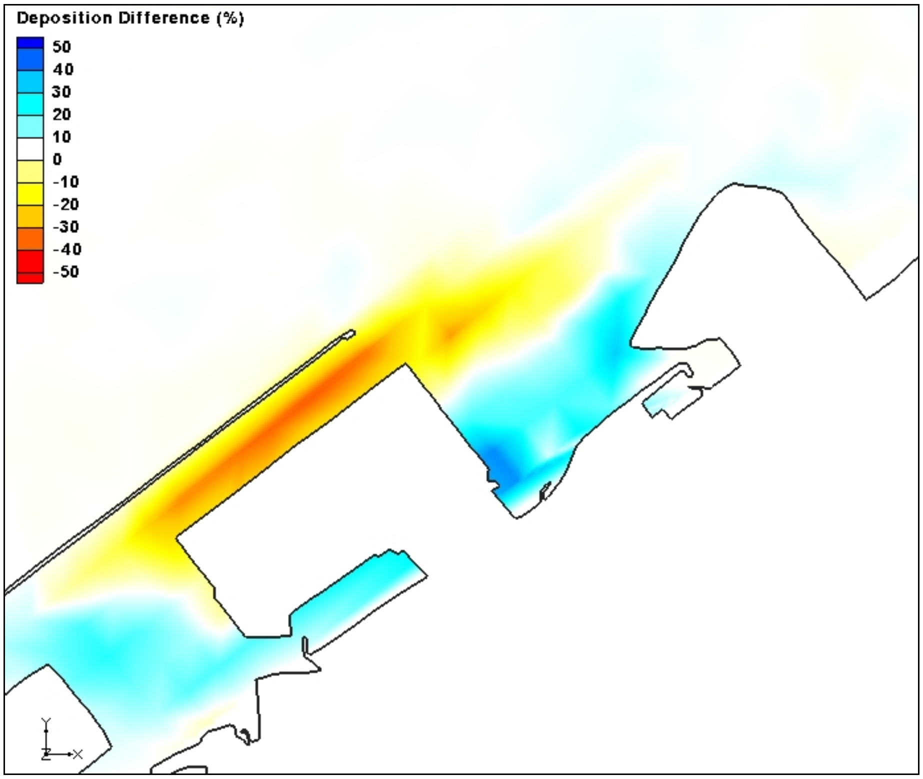


Figure C95. Difference in percent deposition, Configuration 2, 5-year storm

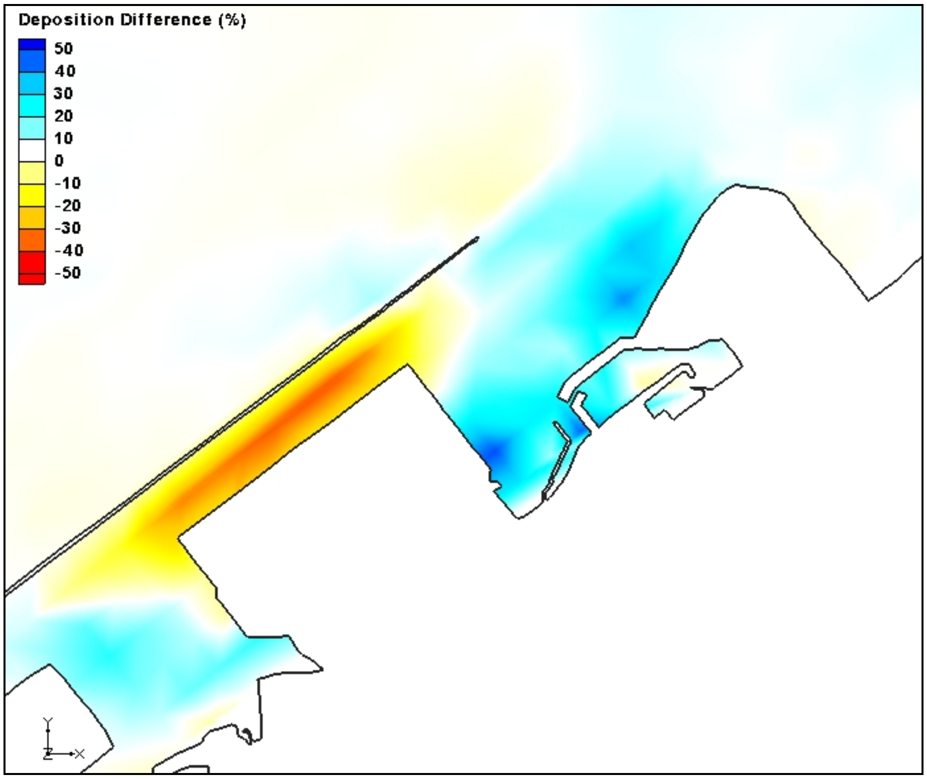


Figure C96. Difference in percent deposition, Configuration 3, 5-year storm

APPENDIX L

REAL ESTATE PLAN

18 Sept 08

DRAFT

REAL ESTATE PLAN
CLEVELAND DREDGED MATERIAL MANAGEMENT PLAN
SPONSOR: Cleveland Cuyahoga County Port Authority

AUTHORITY

The Cleveland Harbor Dredged Material Management Plan (DMMP) is conducted under the guidance of ER 1105-2-100, Appendix E; the Planning Guidance Notebook: The studies are conducted to verify that all Federally maintained navigation projects have sufficient capacity for dredge material disposal for a minimum of 20 years. The studies are conducted pursuant to existing authorities for individual navigation feasibility studies, Preconstruction Engineering and Design (PED) investigations, construction, or Operations and Maintenance (O&M), as provided in Congressional Committee study resolutions and public laws authorizing specific projects.

Cleveland Harbor, Ohio, was initially authorized as a Federal harbor by Congress in the River and Harbor Act of 1875. The 1875 authorization was modified in 1886, 1888, 1896, 1899, 1902, 1907, 1910, 1916, 1917, 1935, 1937, 1945, 1946, 1958, 1960, and 1962 River and Harbor Acts. The project was also authorized under the 1976 and 1986 Water Resource Development Acts (WRDA), the 1985 Supplemental Appropriations Act, and the 1988 Energy and Water Appropriations Act.

Five Confined Disposal Facilities (CDF) have been constructed at Cleveland Harbor; CDF Dikes 9, 10B, 12, 13, and 14. Dike 10B is expected to reach capacity in 2009. It was originally thought that it would reach capacity in 2015 but due to lower lake levels and dredging by private entities, the lifespan of the CDF has been drastically reduced. Fill Management Plans have been developed at the other CDFs for interim capacity.

The Real Estate Plan (REP) addresses the Buffalo District Corps of Engineers' and the Non-Federal Sponsor’s plan to construct a CDF to meet the dredging needs for the Cleveland Harbor Federal Commercial Navigation Project. The new CDF will meet the dredging needs between the year 2014 (the estimated date the new CDF would be operational) and the year 2034 which would provide 20 years of capacity.

1. PURPOSE

The purpose of the DMMP is to develop and evaluate alternative programs to maintain the authorized navigation channel in Cleveland Harbor and Cuyahoga River Channels for a minimum period of 20 years.

The project site is located along the southern shore of Lake Erie at the mouth of the Cuyahoga River in the City of Cleveland, Cuyahoga County, Ohio. The port is located 28 miles east of Lorain, Ohio and 33 miles west of Fairport, Ohio.

The selected alternative for the new CDF is referred to as Alternative Plan 4 and involves the construction of a multi celled CDF: To the south, the East 55th Street site will be bounded by an improved State Park Marina breakwater, the natural shoreline near the terminus of East 55th Street, and a to-be-constructed perimeter wall/dike. A portion of the eastern boundary would be formed by the existing First Energy circulating water intake (necessary improvements will be made to the structure) and the remainder of the perimeter shown will be formed by still to be constructed walls.

The perimeter walls will be comprised of both rubblemound dykes (similar in construction to that of existing Dike 10B) and back-to-back open cell wall design. The CDF would be constructed in optimally sized cells in order to spread out construction costs over time while balancing cost effectiveness. Cell size and sequencing has not yet been finalized, but the combined footprint will not exceed what is shown in the attached sketch. Anticipated volume is 6,850,000 cubic yards, which will provide approximately 21 years of capacity assuming an annual dredging volume of about 330,000 cubic yards per year.

The first cell would be constructed from 2012 through 2014, allowing filling operations to begin in FY15. Additional cells would follow, with each subsequent cell becoming operational as the previous cell is filled.

2. LER REQUIRED FOR CONSTRUCTION, OPERATION AND MAINTENANCE

Based on existing project authorities, the non-Federal Sponsor is required to provide, without cost to the United States, unencumbered, all lands, easements and rights of way and spoils disposal areas necessary. For the Fill Management Plans, CDF10B is still open and in use. Appropriate Rights of Entry have been obtained for CDF 9 and 12 for the Fill Management Plans on those CDFs.

For the selected alternative 4, navigational servitude will apply. The Non-Federal Sponsor will be required to provide the necessary bottomland leases which will be acquired from the State of Ohio. A two acre temporary work and storage area will also be required for three years which will be located on State Park lands.

No present or anticipated mineral activity is within site. Initial plans and specifications do not identify any relocation of public utilities or roadways. There will be no displacement of persons or businesses.

ESTATES

Temporary Work and Storage Area: A temporary easement and right-of-way in, on, over and across tract Nos. ___, ___ and ___, for a period not to exceed three years, beginning with the date possession of the land is granted to the Untied States, for use by the United States, its representatives, agents, and contractors as a work area, including the right to deposit fill, move, store and remove equipment and supplies and erect and remove temporary structures on the land and to perform any other work necessary and incident to the construction of the Cleveland Harbor Confined Disposal Facility project, together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstructions, and any other vegetation, structures, or obstacles within the limits of the right-of-way; reserving, however, to the owners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easements hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

No other estates will be required however the NFS will be required to obtain a submerged land lease from the State of Ohio and will need to provide an Attorney's Certificate validating the lease.

3. LER ALREADY OWNED

The Non-Federal Sponsor does not currently own any of the LERRD required.

4. LER AQUIRED FOR, OR WITH THE USE OF FUNDS FROM, ANOTHER FEDERAL PROGRAMS OR PROJECT

No LER was previously acquired with Federal funds or in conjunction with another Federal Project.

5. NON-STANDARD ESTATES

No Non-Standard Estates are required for this project.

6. EXISTING FEDERAL PROJECTS

There is no existing Federal Project that lies fully or partially within the project area.

7. FEDERAL LAND

There is no federally owned land in the project area.

8. NAVIGATION SERVITUDE

Navigational Servitude does apply.

9. PROJECT MAP

See Exhibit A

10. INDUCED FLOODING

There will be no induced flooding in the project area or as a result of the project.

11. BASELINE COST ESTIMATE

The estimated value of the temporary work area easement is $45,000. This estimate is based upon an assumed value of recreational property at the site, reduced from 50% fee value for 3 years.
Their estimated administrative cost for obtaining the submerged land lease is approximately $5,000. The Federal administrative costs are estimated to be $10,000. This estimate is only for determining an estimated total project cost for planning purposes. It cannot be used in determining the amount of land, easements, and rights-or-way plus incidental costs for inclusion in the final total project costs.

12. RELOCATION ASSISTANCE

The project will not require Relocation Assistance Benefits (Public Law 91-646).

13. MINERALS

No extractable minerals or standing timber of vegetation are on the Project lands.

14. CAPABILITY ASSESSMENT

The Cleveland Cuyahoga County Port Authority is the non-federal sponsor for the new CDF.

The Port Authority has the full power, authority and capability to provide the items of local cooperation. It, also, has the legal capability to provide its share of total project costs. Finally, the Port Authority has the capability to complete its portion of the project within the designated time frames.

The Port Authority is capable of providing all required LERRDs necessary for project construction, operation and maintenance. The Port Authority is a legally constituted public body with the full power, authority, and capability to perform of the terms of the PCA. It has the power of eminent domain. Its legal department is fully capable of handling acquisitions and condemnations. Requirements of PL 91-646, acquisition policies and procedures, LERRD crediting procedures, and the requirements for land acquisition have been discussed with the sponsor. See the enclosed, Assessment of Non-Federal Sponsor's Real Estate Acquisition Capability. Exhibit C

15. ZONING

The enactment of zoning ordinances will not be required for this project.

16. SCHEDULE

LERRD certification will be obtained in accordance with the project schedule.

17. FACILITY OR UTILITY RELOCATIONS

Plans and Specifications do not identify any utilities/facilities that will need to be relocated.

18. ENVIRONMENTAL

The Cleveland Harbor DMMP Environmental Impact Statement (EIS) will ultimately address all requirements of Federal, State, and local policies and law. This report will summarize the results of a detailed multi-year investigation of various options and alternative plans for dredged material disposal at Cleveland, Ohio and will evaluate the engineering, economic, and environmental pluses and minuses of those alternatives. In compliance with NEPA, the proposed project was formally initiated by the widespread mailing of a Public Scoping Information Packet in 2006. A Notice of Intent to Prepare a Draft Environmental Impact Statement (EIS) was published in the Federal Register in 2006. The draft EIS is an on-going document that is open for comment throughout the entire study. The EIS identifies existing conditions in the project area and the environmental effects that the proposed project will have on the project location. Existing conditions that were analyzed include socioeconomics, transportation, water quality/water resources, sediment quality, hazardous, toxic and radioactive waste (HTRW), cultural resources, aesthetics, recreation, fish and wildlife, species of concern, wetlands, geology, climate, air quality and noise. A Fish and Wildlife Coordination Act Report was provided by the U.S. Fish and Wildlife Service in 2007. USACE-Buffalo District will initiate future reports and coordination in compliance with the Clean Water Act and the Coastal Zone Management Act.

Under Section 106 of the National Historic Preservation Act, consultation was initiated through the Scoping Information Packet. Approximately 216 properties in the City of Cleveland are listed on the National Register of Historic Places (NHRP). Of the cultural resources listed, the Cleveland East and West Pier head Lights are located immediately adjacent to three of the proposed areas for new CDFs. While the proposed new CDF would not be constructed immediately adjacent to the East and West Pier heads, care and concern will be taken during construction to avoid damage to the historic lighthouses. Both pier heads have recently been repaired and rehabilitated with sheet pile and armor stone to enhance the structural integrity and stability of the facility.

19. PROJECT SUPPORT

There is no known opposition from the public to this project.

20. RISK NOTIFICATION

A risk notification letter has not been sent out.

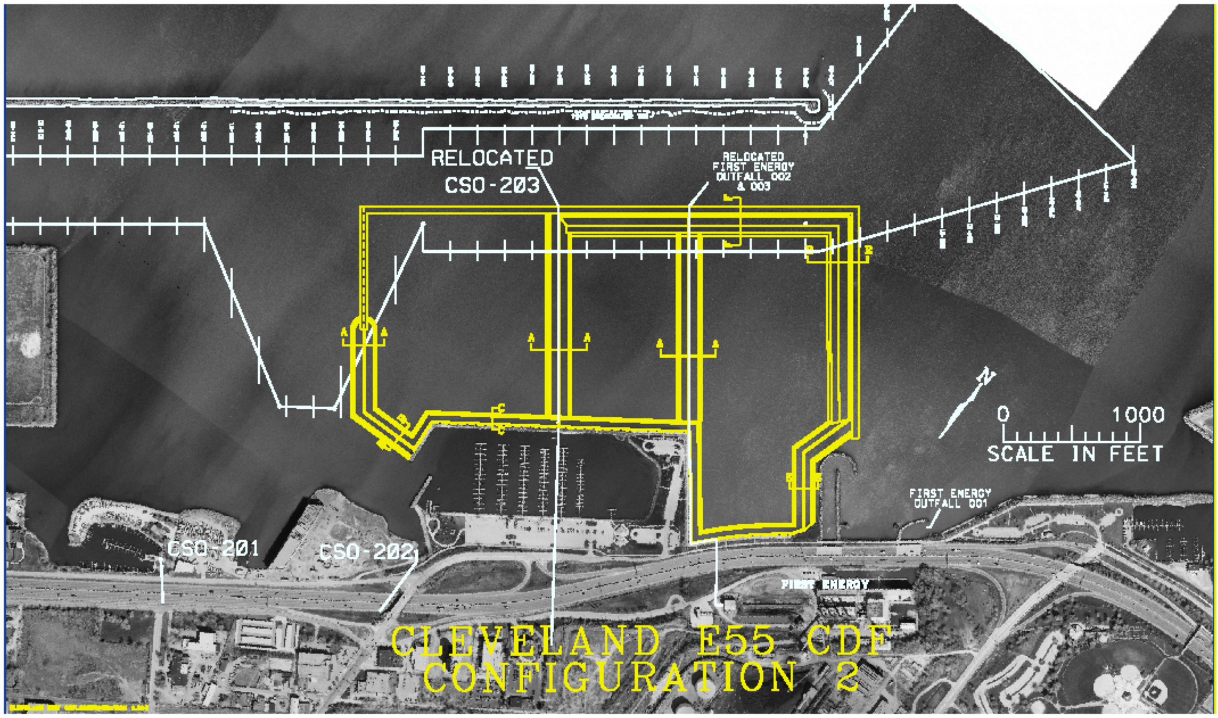
21. OTHER RELEVANT REAL ESTATE ISSUES

The proposed footprint of the East 55th Street site encroaches on the existing Federal approach channel in the east basin and eastern flared portion of the 25-foot deep dock approach channel to the former Nicholson Cleveland Terminal Company pier. These portions of the existing project were authorized but never constructed. These portions of the channel must be de-authorized in order to implement the proposed East 55th Street CDF alternative. The impact of the proposed de-authorization to navigation is negligible. The Nicholson Cleveland Terminal Company is no longer in business; the facility was recently converted to residential lofts. The east approach channel will be realigned, but will maintain its depth and stand-off distances from harbor structures. The width will be reduced to 500 feet to de-authorize the never-constructed portions of the channel. The 500 foot channel width is consistent with the channel width throughout the remainder of the east basin. The distance between the toe of the east breakwater at the eastern end (the widest point) and the face of the CDF is approximately 600 feet. A 500 foot channel would provide a 100-foot wide berth along the face of the pier without impacting the stability of the breakwater.

There are no cemeteries within the project area. There are no special aquatic sites, including wetlands, impacted by the project.

The Detroit District Real Estate Division will coordinate, monitor and assist with all real estate activities undertaken by the Non-Federal Sponsor. If any acquisition activities are required by the Non-Federal Sponsor, the Real Estate Division will assure that the acquisition process is conducted in compliance with Federal and State Laws, specifically, the requirements under the Federal Uniform Relocation and Acquisition Act (P.L. 91-646). The Real Estate Division will also attend district team meetings, review and provide input into draft and final reports prepared by the district team, and participate in the ITR.

EXHIBIT A


RELOCATED
CSO-203
RELOCATED
FIRST ENERGY
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FIRST ENERGY
OUTFALL 001
CSO-201
CSO-202
FIRST ENERGY
CLEVELAND E55 CDF
CONFIGURATION 2

EXHIBIT "C"

DETROIT DISTRICT REAL ESTATE ASSESSMENT OF NON-FEDERAL SPONSOR REAL ESTATE ACQUISITION CAPABILITY

PROJECT: **Dredged Material Management Plan, Cleveland, Ohio**

I. LEGAL AUTHORITY

a. Does the sponsor have legal authority to acquire and hold title to real property for project purposes?

([✓ Yes]/No)

Initials JRJ Date 9/12/08

b. Does the sponsor have the power of eminent domain for this project?

([✓ Yes]/No)

Initials JRJ Date 9/12/08

c. Does the sponsor have "quicktake" authority for this project?

([✓ Yes]/No)

Initials JRJ Date 9/12/08

d. Are any of the lands/interests in land required for the project located outside the sponsor's political boundaries? .

([✓ Yes]/No)

Initials JRJ Date 9/12/08

e. Are any of the lands/interests in land required for the project owned by an entity whose property the sponsor cannot condemn?

(Yes/[✓ No])

Initials JRJ Date 9/12/08

II. HUMAN RESOURCE REQUIREMENTS

a. Will the sponsor’s in-house staff require training to become familiar with the real estate requirements of Federal projects including P.L. 91-646, as amended?

(Yes/[✓ No])

Initials JRJ Date 9/12/08

b. If the answer to II.a. is "yes", has a reasonable plan been developed to provide such training?

N/A

Initials JRJ Date 9/12/08

c. Does the sponsor’s in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project?

([✓ Yes]/No)

Initials JRJ Date 9/12/08

d. Is the sponsor projected in-house staffing levels sufficient considering its other workload, if any, and the project schedule?

([✓ Yes]/No)

Initials JRJ Date 9/12/08

e. Can the sponsor obtain contractor support, if required in a timely fashion?

([✓ Yes]/No)

Initials JRJ Date 9/12/08

f. Will the sponsor likely request USACE assistance in acquiring real estate?

(Yes/[✓ No])

Initials JRJ Date 9/12/08

III. OTHER PROJECT VARIABLES

a. Will the sponsor's staff be located within reasonable proximity to the project site?

([✓ Yes]/No)

Initials JRJ Date 9/12/08

b. Has the sponsor approved the project/real estate schedule/milestones?

([✓ Yes]/No)

Initials JRJ Date 9/12/08

c. Has the sponsor performed satisfactorily on other USACE projects?
([✓ yes]/no/not applicable)

Initials JRJ Date 9/12/08

d. With regard to this project, the sponsor is anticipated to be: [✓ highly capable] / capable/moderately capable/marginally capable/insufficiently capable. (If the sponsor is believed to be insufficiently capable, provide explanation.)

Initials JRJ Date 9/12/08

Prepared by:

JENNIFER R. JANIK
Realty Specialist

Reviewed and approved by:

VICTOR L. KOTWICKI
Chief, Real Estate Division